Electrical Review

THE PIONEER ELECTRICAL WEEKLY OF AMERICA.

VOL. XXXVII. No. 22. NEW YORK, WEDNESDAY, NOVEMBER 28, 1900. ISSUED WEEKLY.

ELECTRICAL REVIEW

Park Row Building,
13-21 Park Row, New York.
P. O. Box 2339.

CHARLES W. PRICE, Editor.
STEPHEN L. COLES, Managing Editor.
CHARLES T. CHILD, Technical Editor.
STEPHEN H. GODDARD, Advertising Manager.
RUSSELL HOWLAND, Assistant Advertising Manager.

Registered Cable Address:
"Electview," - New York.

Telephone Call, 21 "Cortlandt."
(Private branch exchange connecting all departments.)

Western Office:
FRANK E. COLBERT, Representative, 1612-1613 Marquette Building, Chicago.

Washington Office:
GEO. C. MAYNARD, Representative, Room 102 Washington Loan and Trust Building, Washington, D. C.

London Office:
HENRY W. HALL, Representative, 42 Old Broad Street, London, E. C.

News, Subscriptions and Advertisements.

Subscriptions to the
ELECTRICAL REVIEW.

One Year, United States and Canada, - - - $3.00
One Year, Foreign Countries, - - - - - - 5.00
Single Copies, each, - - - - - - - - .10
Copies can be supplied for only one year back at 25 cents each.

ELECTRICITY ON THE NEW YORK ELEVATED RAILWAYS.

The last week will doubtless be looked back upon as an epoch in the history of transportation in New York city. For the first time a service electric train has been run on one of the lines of elevated railway with the greatest success; and within the shortest possible time permitted by the physical difficulties of installing so large and extensive a plant the whole system of four parallel trunk lines in the boroughs of Manhattan and the Bronx will be in complete electrical operation. The system chosen is one that commends itself as exceedingly simple, strong, and containing no unnecessary refinements which might lead to breakdowns and unsatisfactory work.

While it is difficult to look ahead with certainty and count the good results that will flow from this equipment, still it is certain that even now one may see a little of the benefit that will be brought in the future by the change from steam to electricity. On account of its physical configuration the City of New York, that is, the portion comprised in the boroughs of Manhattan and the Bronx, has but one direction in which to grow, and that is northward, or away from the region which is now the centre of business activity. While some classes of business may follow the uptown movement of population, the vast sums that have been expended in the erection of buildings for manufacturing and office purposes and the situation of the termini of the various railways and steamship lines entering the city, will never permit the abandonment of the lower end of Manhattan Island as a business centre. Into and out of this centre there flows daily a stream of people certainly not less than a million in number. Of all the directions in which suburban homes may be built, or wherein new streets of residences and apartment houses may be opened, none has better natural characteristics than the portion of the city lying to the north of the Harlem River. It is this large and, as yet, not thickly inhabited section that is served by the elevated railway, as well as the populous residential district north of the lower end of Central Park on both sides of the city. Even with the inadequate and unsatisfactory method of traction now in use, the combined lines of the Manhattan Railway Company at present transport more than six hundred thousand passengers a day.

It is well known that the movement of population in cities, and even in more extended districts, follows the line of least resistance; in other words, transportation facilities engender the population of new districts and make patronage for themselves. Probably the immediate influence of electrifying the elevated railway will be a large and continuous influx of population into the Bronx district; and, if one may estimate the volume and importance of this by the accelerating growth of various districts of the city during the past few years, it seems likely that even the present excellent equipment which is being installed will prove entirely inadequate before the underground railway now under construction is completed. Even with electricity the capacity of the elevated system, as it stands at present, can not be increased more than about fifty per cent.

It is curious what extraordinary results may follow the smallest errors of judgment. Nearly a century ago a board of surveyors was appointed by the municipal authorities of New York city to lay out a plan for the future extension of the city northwardly upon Manhattan Island. These estimable gentlemen laid out an elaborate rectangular system of straight streets and avenues, and to it the city has strictly adhered in its growth. But, most unfortunately, they put on their plans only about ten avenues running northward, where the movement of the people would be greatest, and some two hundred and sixty-five cross streets running the other way, where there is practically no movement at all. The consequence of this arrangement has been that all of the avenues are at present crowded and sometimes even blockaded with the vast traffic of goods and passengers that pours through them. One may be pardoned if one looks ahead, even beyond the completion of the elevated and underground electrical systems now in construction, and contemplates the state of things that will

obtain in New York when this city is practically continuous up to and beyond Yonkers and White Plains. At the present rate of progress this will be within forty or fifty years. Whether it will mean double-decking the streets, building more tunnels, or the use of flying machines, which may be perfected by that time, is beyond even the power of the imagination to fancy.

A POLYGLOT TECHNICAL DICTIONARY.

A project is now on foot for the compilation by the various engineering societies of the world of a technical, industrial and commercial dictionary in the French, German and English languages. That such a work is needed and badly needed is readily seen by any one who will look at a translation from an article in English in some of our contemporaries published in other languages; we regret to say that, sometimes, it may be seen in alleged translations into English of French and German articles. Assuming that such a work could be published at a reasonable price and within a reasonable time there is yet a grave fear, however, that its usefulness would be somewhat limited by the rapid growth of technical terms due to the continuous progress of invention in the various civilized countries of the world. In our own language, for example, there have been introduced of late many terms current among engineers which are not to be found in dictionaries. The automobile, the electric car and particularly power transmission work have introduced into our vocabularies a number of terms that must be absolutely unintelligible to foreign readers. Hence it seems at least pertinent to suggest that if a polyglot dictionary is to be published it should be published in somewhat the same way as is the familiar railroad guide —that is, in the cheapest of bindings and so that new editions might frequently be brought out to replace those that had become out of date. Even if this were not carried on further than a few editions it certainly could do no harm to bring out, first, a cheap paper edition so that the technical world might use it long enough to discover its defects and omissions; these might be supplied in later editions of a more permanent character. Anybody who has to do with technical articles in foreign languages will appreciate the need for such a dictionary, especially in the electrical field. One excellent technical dictionary which is well known and much used, and which was published about ten years ago, is almost silent regarding electricity though very complete in the words belonging to other branches of industry and engineering.

A most important question that will have to be settled by the compilers is how far they will go. If they confine themselves to electrical, mechanical and civil engineering the dictionary will be very large if it is complete, but if they go into the innumerable industries and arts that are dependent on these and other varieties of engineering application it is greatly to be feared that the dictionary, to be valuable, must be very bulky and necessarily very expensive. With all desire to see so good a work undertaken and completed we yet feel that the compilers are entitled to considerable sympathy, for no matter what the result of their labors may be they are certain to be blamed; and the work—seeing that it is merely human—must be incomplete in some particular.

A good topographical and geological map of Canada, if looked at with a discerning eye, possesses at the moment the deepest interest for the electrical engineer. That region, ever since the first *voyageurs* tramped through its vast wilderness and eked out a difficult living by hunting and trapping, has been considered inhospitable and of little value on account of its forbidding Winter climate. People have gotten into the habit of thinking of the northern part of Canada as a region wrapped in perpetual snow and of interest to nobody but the hunter, the trapper or the fisherman. We know now, however, that the region lying to the south of Hudson's Bay is rich with every variety of mineral and abounds in magnificent water powers. The only thing that it needs for its exploitation and development is a system of transportation which could easily be electrical. The electrical development of the many magnificent water powers of Canada can not fail to bring about also metallurgical processes for the reduction of the various ores found in that country. Indeed, Northern Quebec and the Labrador Peninsula should no longer be looked upon as unfavored regions, but toward them should be turned the careful attention of the miner, the engineer and the chemist.

The article on other pages of this issue describing the growth of the long-distance service of the Erie telephone system in the middle-western states is interesting as showing the extraordinary growth of methods of telephonic communication in this country. Not long ago we indulged in a little prophecy concerning what might be hoped for in telephony in the course of the next few decades, and now it seems that developments are rapidly being made along lines that will lead inevitably to the universal distribution of telephones. By the one system described in the article referred to, the inhabitants of two thousand eight hundred towns and villages are put in communication with one another. It should be remembered that this system is only one of many and that, even in its own territory, there are also other systems so that the extraordinary total of subscribers and lines shown by it in its district does not fully represent the number of telephones actually in use in that region.

Nothing of more significance has occurred lately than the formal opening of the third-rail system of the Albany and Hudson Railway and Power Company near Albany, N. Y., which is described on other pages of this issue. The ELECTRICAL REVIEW has already, in describing this fine installation, called attention to the numerous points of excellent engineering embodied in it, but its greatest significance is as a long step in the direction of progress to which our railroads are ultimately tending. The line is the longest and most important electric railroad of its class. It is intended to handle freight and passengers in a difficult climate, and under conditions by no means easy. That it will succeed is a foregone conclusion, and the enterprising gentlemen in whose brains the idea originated, and from whose pockets came the money for its realization, are to be congratulated no less upon their excellent investment, than upon the clear vision with which they have seen the future possibility of railroading as it will be in the twentieth century.

Science Brevities

A Heated Insulator—Under this title, in this column of the ELECTRICAL REVIEW for October 4, 1900, appeared an article describing the device, by a Norwegian inventor, of a high-voltage insulator designed to be electrically heated so that films of moisture would not form upon its surface. It appears that the same thing in all its details is fully described in a patent dated March 31, 1896, and granted to Mr. Patrick B. Delany, the well-known telegraph engineer. Mr. Delany's patent was for a system of conduit electric railway and exhibited this same method of heating the conduit insulators to avoid the precipitation of moisture upon them.

Cathode-ray Coloration — Some colorations resembling those due to the oxidation of steel have been obtained with cathode rays by Herr W. B. von Czudnochowski. His results are thus described by Mr. Fournier d'Albe: He uses a spherical bulb and a spherical cathode, and exposes crystals of fluorspar or rock salt to the radiation from the cathode just below the point at which the rays converge. The violet coloration of colorless fluorspar has long been known, but with the arrangement described the uniform bronze color seen by reflected light is replaced by colored rings. The extreme edge appears bronze-colored; then comes a full yellow, then red, and, lastly, a bluish-violet in the centre. On further exposure, the rings widen out and a new system is developed in the centre. After 15 minutes' exposure colorless Tirolese fluorspar shows the following rings, counting from the edge: silver-grey, yellow, orange, brown, blue. Northumberland fluorspar and rock salt show similar colors, which are, however, masked, in the case of the latter, by the uniform brown coloration of the whole surface. The regular series of colors appears to be: grey, yellow, orange, brownish-yellow, violet, yellow, red, violet. The series observed in steel is: straw-yellow, orange, red, dark blue, light blue, pink, green, water-blue, pale yellow. Newton's rings follow the reverse series.

Coherer Materials—A large variety of metallic powders have been examined by Mr. T. Mizuno with regard to their behavior in coherers. The point chiefly studied by the Japanese physicist is the change produced by several successive sparks, and for this purpose he noted the value of the resistance after every spark up to 25, says an *Electrician* abstract. He finds that in platinum, lead, nickel, aluminum, cadmium, copper, steel, and potassium coherers, the action of electric waves is to reduce their resistances at first to a large extent, and then this reduction continues, though with some intermediate rise and fall until the resistances assume certain final values. In the case of tin, bismuth, zinc, antimony, and especially iron, the resistances are diminished at first, but soon afterwards the changes become very irregular, the diminution and increase occurring at random. But it often happens that zinc, lead and potassium coherers, as well as those made of electric fuse, suddenly assume an infinite resistance. In the case of coherers with mixed metals, such as iron with silver, cadmium, Rose's or Wood's metal, and also silver with Wood's metal, the mode in which the resistance changes seems to be chiefly governed is shown by the percentage ratio of the constituents. In fact, the history of each coherer presents the character which would belong to the predominant constituent.

Diffusion of Gases and Liquids—In his presidential address to the Chemical Section of the British Association, Professor Horace T. Brown, F. R. S., dealt with the fixation of carbon by green plants from the carbon dioxide of the atmosphere. This work has necessitated a further study of the laws of static diffusion, which he is carrying out in conjunction with Mr. E. Escombe. We know very little about a diffusion in very diluted gases, and carbonic acid constitutes only 0.03 per cent by volume of the atmosphere. If we place an open cylinder, whose bottom is covered with caustic potash lye, in the air, the layer of air next the liquid will rapidly be deprived of its carbonic acid. With a static flow of dioxide down a short column, and a perfect absorbent, the diffusion will be proportionate to the area of cross-section, and will practically be independent of the percentage of CO_2 present. But if we cover the cylinder with a diaphragm, the rate of flow will be accelerated as the aperture is diminished; and when the rim of the diaphragm is about two or three times as wide as the aperture, the flow will become inversely proportional to that diameter. This diameter (not cross-section laid) holds also for aqueous vapor and solutions of sodium chloride, when the mobility of the liquid in the latter case has been destroyed by addition of gelatine. As the carbon dioxide particles move on convergent hyperbolic lines towards the aperture, we get surfaces of equal density—density shells—above and below a circular aperture, which shells may be rendered visible with the aid of colored liquids; these ellipsoids are in agreement with theory. When diaphragms with many perforations are applied, the rate of flux increases as these apertures are reached, and decreases again when they have been passed.

Recording Apparatus for Wind Direction—A new apparatus for recording eight directions of the wind by means of two styles has been adopted at the Agricultural College of Berlin. The general arrangement is that introduced by Herr Sprung. A current distributor follows the movement of the vane. This distributor consists of a platinum sector of 135 degrees, turning about a vertical axis over four platinum contacts, connected with four electromagnets. The axis is joined to the one pole of an accumulator cell. The electromagnets are arranged in two pairs corresponding to the wind directions north-south, east-west. In front of each of the pairs swings a pendulum, provided with an oil damper. A deflection in the one pendulum to the left means north wind, to the right south wind; the deflections of the other pair indicate east and west wind, and the combination of the two simultaneous movements gives the intermediate directions. The pens are attached to the ends of the pendulums and draw parallel curves on a paper tape, which is being pulled downwards by a small weight. If a continuous record is desired, the common return from the four electromagnets is taken directly back to the other pole of the cell. At Berlin, however, a relay is interposed, whose circuit is, by means of clockwork, which also releases the tape, energized every three minutes. Thus 20 wind records are obtained per hour. The apparatus works with very small currents of 0.01 ampere, and the current intensity might still further be diminished, in order to spare the contacts, by winding the coils of the electromagnet with finer wire. The current distributor does not retard the movements of the vane to any appreciable degree, and it is protected against the vertical jerks of the vane. The apparatus is described by W. Volkmann in the *Zeitschrift für Instrumentenkunde.*

American Society of Mechanical Engineers.

The principal railway associations have granted a rate of one and one-third fare to delegates attending the meeting of the American Society of Mechanical Engineers, at New York, December 4 to 7, inclusive.

THE THEORY OF ALTERNATING DYNAMO-ELECTRIC MECHANISMS—V.

BY W. ELWELL GOLDSBOROUGH.

Example No. 3.

Determine the form of the magnetization curve that will induce an electro-motive-force curve like the heavy curve in Fig. 17. Assuming that this electro-motive-force curve is generated by an alternator having eight poles and eight coils of 100 turns each connected in series on its armature, find what maximum value of the magnetization will be necessary to produce a maximum electro-motive force of 1,000 volts at the brushes, when N = 50.

Referring to Fig. 17, the heavy curve is seen to be perfectly symmetrical; therefore draw the vertical line (Pp) from the point (P) that bisects (SQ), it will bisect the area SpQPS. Now divide (PQ) into five equal parts at b, e, h, k and n, and draw the lines (ba), (ed), (gh), (jk) and (mn).

The area of PpabP = .3808 sq. in.
" " P$padeb$P = .7965 sq. in.
" " P$padghebP$ = 1.2305 sq. ins.
" " P$padgjkhebP$ = 1.6398 sq. ins.
" " P$padgmnkhebP$ = 1.9450 sq. ins.
" " P$padgmQnkhebP$ = 2.0688 sq. ins.

For the first point on the negative loop of the magnetization curve lay off on ab the distance bc = .3808; for the second point lay off on de the distance ef = .7965; for the third point lay off on gh the distance hi = 1.2305; for the fourth point lay off on jk the distance kl = 1.6398; for the fifth point lay off on mn the distance no = 2.0450; for the sixth point lay off on VQ the distance Qq = 2.0688, which gives the maximum connecting P$cfilog$. One-fourth of the magnetization curve is complete.

Since the electro-motive-force curve is perfectly symmetrical, the magnetization curve will be symmetrical in a like manner, and the three remaining quadrants Rs, sP and qP', are readily constructed making one cycle of the curve of magnetization, RsPqP', complete.

It is noticeable that although the electro-motive-force curve differs *materially* from the *sine form*, the curve of magnetization differs but *slightly*, showing that small variations of the magnetic flux will produce marked distortions in the electro-motive-force curves.

Again, to maintain a constant electro-motive force at the terminals of the given armature for T ÷ 2 = 1 ÷ 2 n = .01 second would require a total uniform variation of the magnetic flux cutting the armature coils from zero to a maximum of,—

$$\Phi_1 = \frac{E \times T \times 10^8}{C \times 2} = \frac{1000 \times .02 \times 10^8}{200 \times 2} = 5000000 \text{ webers,}$$

since all of the armature coils are connected in series and during one period each coil cuts one-eighth of Φ_m, which is the same as if one coil cut Φ_m. This magnetization is represented by the area PSuvQP = 5.25 square inches = A_1, therefore

$$\Phi_m = \frac{\Phi_1 A}{A_1} = \frac{A \times E \times T \times 10^8}{A_1 \times C \times 2} = \frac{2.07 \times 1000 \times .02 \times 10^8}{5.25 \times 200 \times 2} = 1971500 \text{ webers} = Qq, \text{ Fig. 17.}$$

It is also possible to determine the form of the electro-motive-force curve that will be produced by a known cyclic change in the magnetization threading a coil. Equation (36) shows that the electro-motive force will lag 90° behind the magnetization, and equation (32) represents a relationship that exists in all cases however complex the wave motions may be; from a consideration of these a graphical solution is readily devised.

In Fig. 18 the curve R$sabc$Pq is the given curve of magnetization. At (s), the highest point on the curve, and at (a), (b), (c), (m) and (n), draw tangents to the curve; then at some point on the horizontal axis, as (X), erect the perpendicular YXY', and from some convenient point (O) on (RX) draw lines parallel to these tangents until they intersect (YY') in the points (x), (l), (k), (j) and (w) respectively.

Now through (s) draw a vertical and through (x) a horizontal line, the point (S) at which these meet will be a point on the electro-motive-force curve and also the point at which the electro-motive-force curve crosses the (X) axis in a positive direction. Through (a) draw a vertical and through (l) a horizontal line, and the point (g) at which they intersect will be another point on the electro-motive-force curve. In this way the points (h), (i), (v) and (u) are also constructed as indicated in the diagram. The tangents at (m) and (o) are parallel, therefore the point (w) on (YY') suffices for both (u) and (v) which fall on the same horizontal line.

The electro-motive force by this construction lags 90° behind the curve of the magnetization that produces it, and its ordinates represent the rate at which the lines of force are cut, for in the equation,

$$e = -\frac{d\Phi}{dt} \qquad (32)$$

(dt) is a constant, since (t) is the independent variable and therefore increases by equal increments, and

$$e \doteq d\Phi. \qquad (37)$$

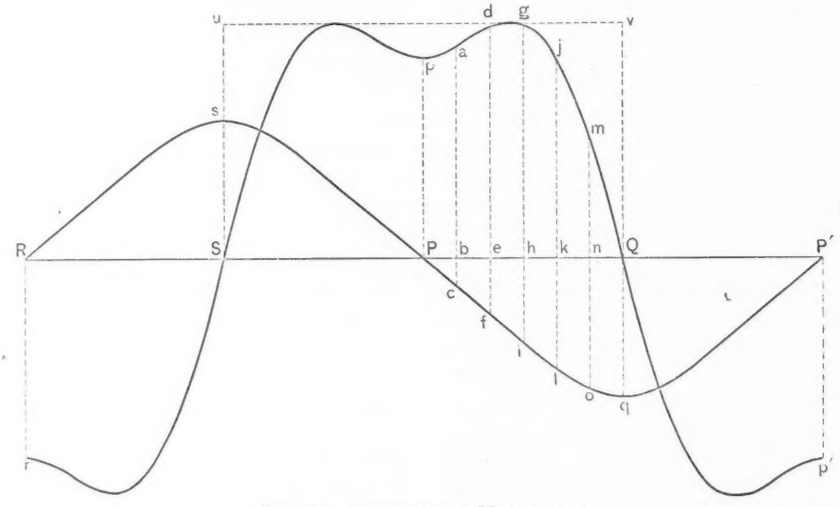


FIG. 17.—ALTERNATING MECHANISMS.

In the graphical construction this relationship of these quantities has been maintained by keeping (OX) that represents (dt) constant, then (Xl), (Xk), (Xj), etc., are proportional to the successive values of $d\Phi$ and therefore to (e), and may be taken to represent the values (dg), (eh), (fi), etc., of (e) corresponding to the magnetizations represented by (da), (eb), (fc), etc.

In connection with Fig. 18 it is to be noticed that the maximum magnetization does not occur at the point that bisects (RP), and that it is not a sine function. This accounts in part for the irregular shape of the electro-motive-force curve, and the peak at (i) is due to the tangent at (e) making a greater angle with (OX) than any other.

ON CIRCUITS CONTAINING RESISTANCE AND INDUCTANCE.

Up to the present nothing has been said regarding alternating currents of

electricity; we have simply considered the generation of alternating electro-motive forces in coils through which the circuits are not completed.

Suppose we have a source of alternating electro-motive force arranged to act upon a circuit consisting of two parallel lines of wire of resistance (R), leading to an air core solenoid, of negligible resistance, and made in the form of a torus. When the circuit is closed, and a state of uniform variation of the forces involved has been reached, it will be found that a variable current (i) is flowing in the circuit, but that its value at any instant is less than the instantaneous value of the electro-motive force acting divided by the resistance of the circuit owing to the reactive effect produced by the variable current flowing through the solenoid. The current creates a magnetic field of varying intensity, the lines of force of which in cutting the coils induce a counter electro-motive force in the coils which opposes the electro-motive force of the source and thereby diminishes its effective value. In other words, the equation of electro-motive forces of the circuit will have the form,—

$$e = -e_r' - e_l' = i\,\mathrm{R} + e_l = e_r + e_l \quad (38)$$

in which (e_r') is equal and opposite to that portion of the electro-motive force of the sources that is used up in overcoming the resistance of the circuit and (e_l') is the counter electro-motive force just referred to; $i\,\mathrm{R} = -e_r' = e_r$, since ($i$R) and ($e_r$) are equal to that component of the electro-motive force of the source which overcomes the resistance, and (e_l) is equal and opposite to (e_l'), i. e., $e_l = -e_l'$. Again the magnetic field that induces the counter electro-motive force results directly from the current and whatever variations take place in the current, like variations will take place in the magnetic field, therefore

$$d\,\mathrm{N} \doteq d\,i \quad (39)$$

under all circumstances. If the solenoid contains (n) turns, has a radius of (r) centimetres and a mean circumferential length of (l) centimetres, a variation in the current of (di) amperes will produce within the solenoid a variation in the magnetic flux equal to,—

$$d\,\Phi_m = \frac{4\,\pi}{10}\,d\,i\,\frac{n\,\pi\,r^2}{l} \text{ lines of force,} \quad (40)$$

but the number of lines of force that will cut the coil will equal

$$d\,\Phi = \frac{4\,\pi}{10}\,d\,i\,\frac{n\,\pi\,r^2}{l}\,n = \frac{4\,\pi\,n^2\,\mathrm{A}}{10\,l}\,d\,i, \quad \text{where } \mathrm{A} = \pi\,r^2, \quad (41)$$

and if we make

$$\frac{4\,\pi}{10} \times \frac{n^2\,\mathrm{A}}{l} = \mathrm{L}, \quad (42)$$

then

$$d\,\Phi = \mathrm{L}\,d\,i, \quad (43)$$

therefore

$$e_l' = -\frac{d\,\Phi}{d\,t} = -\mathrm{L}\,\frac{d\,i}{d\,t}. \quad (44)$$

The coefficient L is called the *coefficient of self-induction* and expresses the *inductance* of the coil and is defined as the ratio of the total induction threading a circuit to the current producing it. From equation (44) it is seen that,—

$$\mathrm{L} = \frac{d\,\Phi}{d\,i} \text{ or } = \Phi \div i \quad (45)$$

which agrees with the definition just given, therefore when $i = 1$, i. e., when the current is unity, the coefficient of self-induction is equal to the number of lines of force,—

$$\left(\frac{4\,\pi \times n^2 \times \mathrm{A}}{10 \times l}\right), -$$

produced by the current.

Now since $d\Phi = \mathrm{L}\,di$ under all circumstances, if the current varies as a sine function of the time, then Φ will vary as a sine function of the time and will be in phase with (i). It has already been shown (see page 539, equation 36) that the electro-motive force induced by a harmonically varying magnetic field is also harmonic, and lags 90° behind the field, therefore the counter electro-motive force of a coil, or, as it is more properly called, "*the electro-motive force of inductance*," will be a sine function when the current is a sine function and will lag 90° behind the current.

On the other hand, (e_r) is always in phase with (i), since $e_r = r\,i = \text{const.} \times i$, although like e_l it is a sine function when the current is a simple harmonic.

From the above it will now be evident that in equation (38) the two right hand members are sine functions and differ in phase by 90°, if (i) is a sine function. The electro-motive force of the source, (e), is equal to the sum of (e_r) and (e_l) at any instant of time, therefore, since (e) is the resultant of two simple harmonics, having the same frequency, it is also a simple harmonic of like period (see pages 479 and 480).

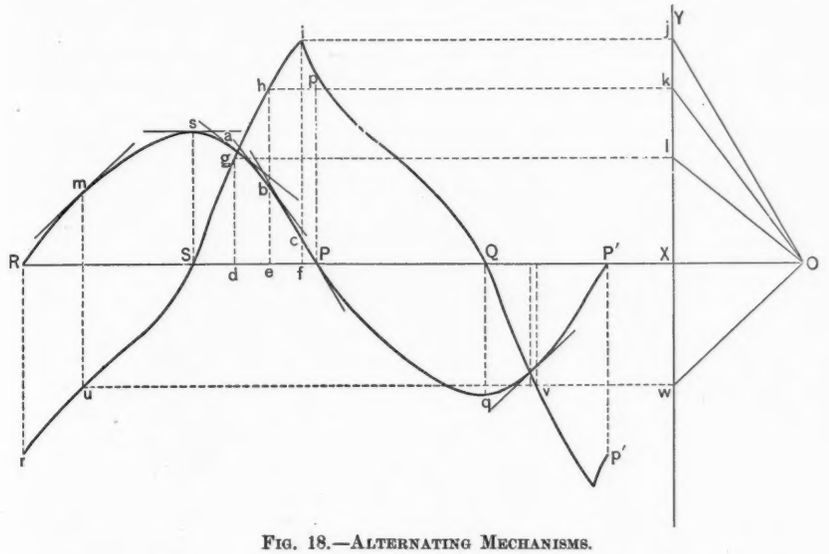


FIG. 18.—ALTERNATING MECHANISMS.

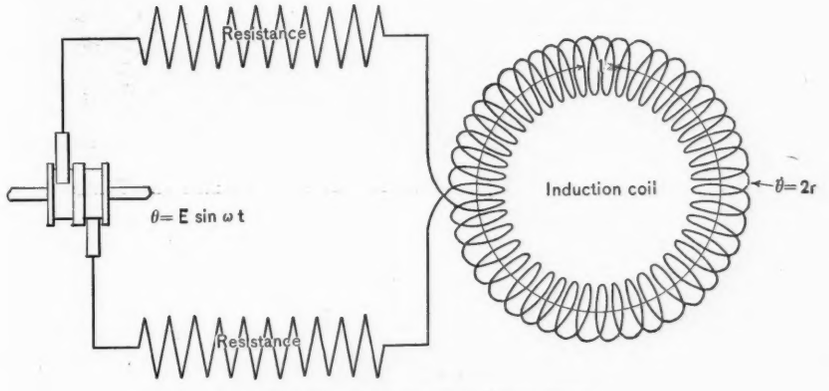


FIG. 19.—ALTERNATING MECHANISMS.

THE LONG-DISTANCE SERVICE OF THE ERIE TELEPHONE SYSTEM.

BY ARTHUR STANLEY RIGGS.

The phenomenal development of the telephone is nowhere better illustrated than in the growth of the long-distance service of the various companies comprising the Erie telephone system. For years the various telephone companies throughout the country considered the "toll-line" business as a side feature of the telephone, and while in a number of cases these toll lines were considered profitable, and efforts were made to handle the traffic in a systematic manner, in the majority of cases the lines were poor, and such traffic as was offered was sandwiched in with exchange work.

The construction of the New York-Chicago line by the American Telephone and Telegraph Company in 1892, called emphatic attention to the possibilities of the telephone. The officers of the Erie Telegraph and Telephone Company decided on extensive improvements in the toll-line facilities of the Southwestern Telegraph and Telephone Company, operating in the states of Texas and Arkansas, and the Northwestern Telephone Exchange Company, operating in Minnesota, North Dakota and South Dakota, both of which companies were controlled by the Erie company. In fact, these companies passed from the "toll-line" to the "long-distance" stage of the business. The subscriber, in place of paying a "toll" to talk on a grounded line to a few suburban points, was soon to have at his command a long-distance system which would place him in quick communication with subscribers throughout the territory. Eighteen months ago the Erie company secured control of the Michigan Telephone Company and the Wisconsin Telephone Company, and when the extensive improvements now being made are completed, Michigan and Wisconsin will, with the states above mentioned, take front rank in the country both in the character of long-distance service given and the amount of traffic handled.

The growth of the long-distance business of the Erie system forms a unique chapter in the history of the telephone business. Perhaps this can be best illustrated by a casual glance at the changes at Dallas, Tex. Seven years ago there were four grounded iron wire lines running out of Dallas, and service was limited to a few towns in the immediate vicinity of that city. The lines terminated on an exchange position, the traffic being so light that the operator put in one-half of her time on local work. Today 52 metallic circuits, 48 of them copper, centre at Dallas, and are carried by a magnificent belt line to East Dallas, where a handsome building, devoted exclusively to long-distance business, forms the operating station for handling traffic from Dallas to over 1,000 stations in Texas and Arkansas. Three No. 8 copper circuits entering Dallas make conversation with points 1,000 miles away an every day occurrence. The one operator, giving half of her time to exchange work, has been succeeded by a force of 40 operators who work on long-distance switchboards of the latest design, and handle a traffic, the details of which are constantly watched by a force of trained traffic men.

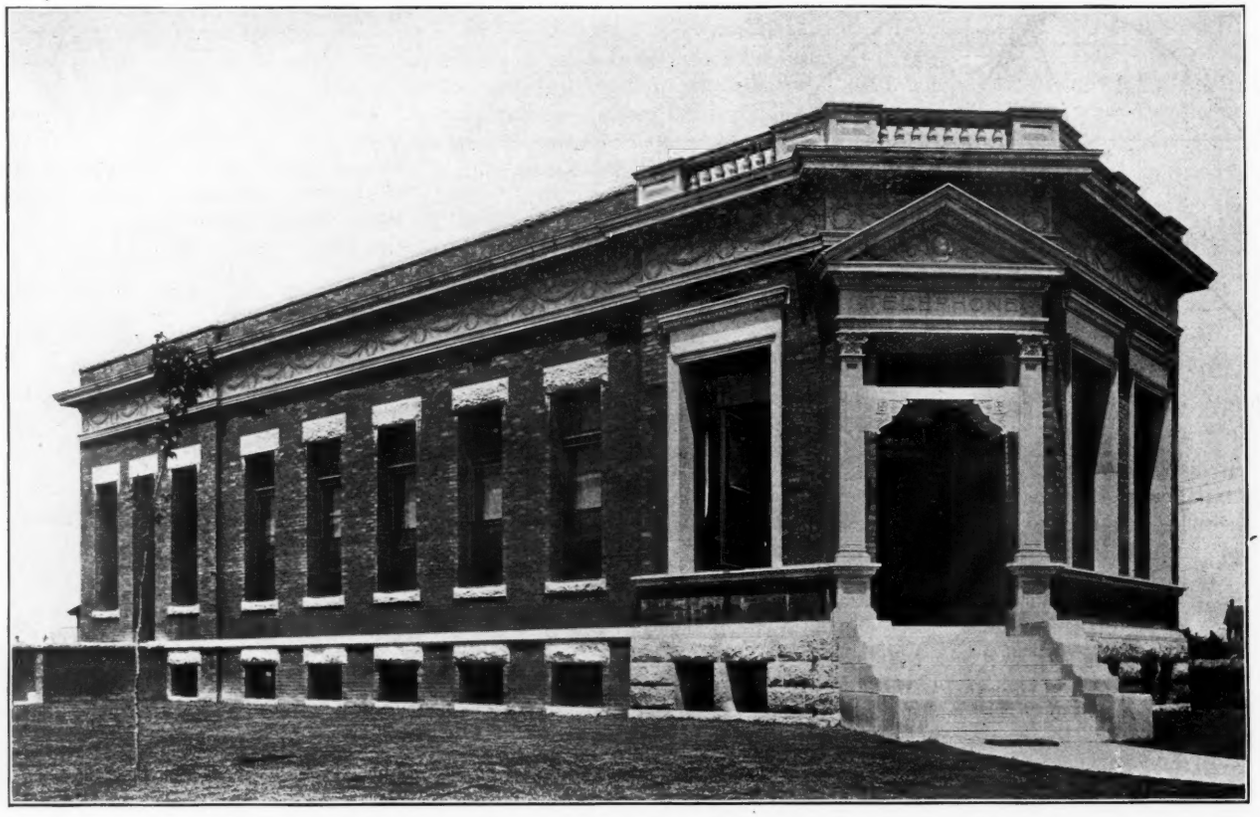


FIG. 1.—LONG-DISTANCE TELEPHONE OPERATING STATION AT DALLAS, TEX., ERIE SYSTEM—SOUTHWESTERN TELEGRAPH AND TELEPHONE COMPANY.

What is true of Dallas is true, in many ways, of all of the larger cities in the company's system. Particular mention has been made of Dallas because to most telephone men Texas is a "jumping off" place, and few appreciate that the Lone Star State is excelled by no other in point of the completeness of its long-distance lines and service. The Texas and Arkansas plant, a complete system in itself, embraces over 38,000 miles of wire out of the total of 94,209 miles operated by the Erie com-

pany. When the present construction plans have been carried out the wire mileage in the Southwest will be about 25 per cent of the total. In other words, within two years the various Erie companies will have upwards of 150,000 miles of long-distance lines—enough to circle the globe six times. The territory operated by the company contains 12 per cent of the total population of the United States, and while the present construction plans will increase the wire mileage to the figure mentioned there is no telling how much more work will be necessary to include connection with numerous hamlets and villages which need service, nor how great an increase in circuits will be needed to carry the traffic between stations already reached by telephone. The company has had phenomenal success, due very largely to President Charles J. Glidden's policy of furnishing good service at low rates.

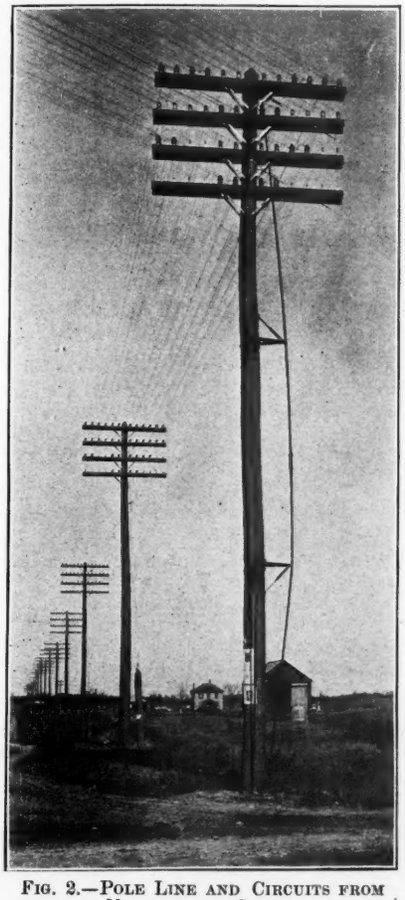


FIG. 2.—POLE LINE AND CIRCUITS FROM MINNEAPOLIS, SOUTH.

"Good service" being the basis for heavy traffic, it follows that the construction work of the long-distance lines is of the first order. The various lines have been built under the most rigid specifications, both as to material used and in the character of the work done. The pole lines vary from 25 feet to 50 feet, according to the number and size of cross-arms to be carried, and where unusually long poles have been set to get good clearance, particular attention has been paid to grading, thus making an even distribution of strain as well as giving the line a trim appearance. Poles are set 36 and 40 to the mile. The details of guying at turns and at all other critical points, by means of anchor, stub and guys, truss guys, etc., are of the first order. On some of the earlier lines built, four-pin cross-arms were used, but during the past three years nothing but six-pin and ten-pin cross-arms have been used, with the exception that 12-pin arms have been used in some places where there seemed to be a probability that, in the near future, the traffic would necessitate a particularly large number of circuits.

The belt line around Dallas, as shown in the accompanying illustration, carries 12-pin arms. Another picture, showing a handsome line carrying, on 12-pin arms, the lines running from Minneapolis, south, gives an idea of the detail of guying. The pole in the foreground is one of the two "corner" poles, and while two heavy guys run toward the right, two trusses make the pole self-supporting, thus furnishing a double protection. To further protect the corner, adjoining poles are also heavily guyed. All corners, turns, railroad crossings, etc., are double armed. Long Michigan cedar poles being very scarce, cedar poles have been brought from Idaho. The long poles shown in the accompanying illustrations of the belt lines at Detroit and Dallas are built of Idaho cedar.

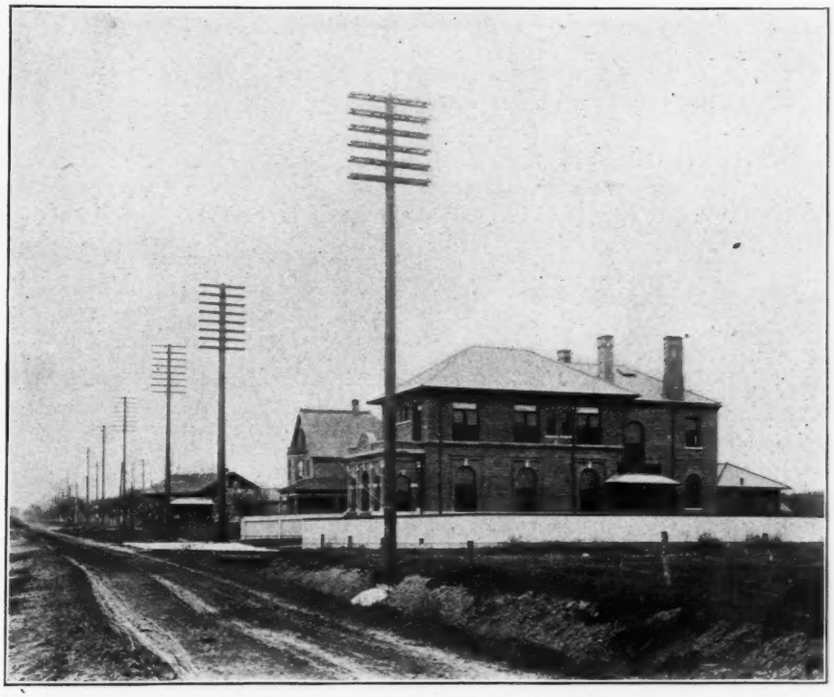


FIG. 3.—THE MICHIGAN TELEPHONE COMPANY'S LONG-DISTANCE STATION AT DETROIT.

The equipment of the various long-distance boards is designed to meet requirements according to the character of the business handled. The engineering department of the company has, during the past year, engineered new long-distance boards for Detroit, Dallas, San Antonio, Waco, Minneapolis, St. Paul, Grand Rapids and a dozen other places where common battery boards have been installed in the company's exchanges. The new boards at the "relay station" at Detroit, which will be put in operation early in the year, and the boards installed during the Summer at the East Dallas station, both built by the Western Electric Company, are examples of the most modern apparatus, designed especially to meet the requirements of quick service combined with a particularly heavy traffic. New boards are being installed at Minneapolis, and within a few months new boards will be installed at Houston and at Milwaukee. These five points, Dallas, Detroit, Houston, Milwaukee and Minneapolis, are the heaviest traffic centres in the system.

Early in 1899 it was decided by the management of the Erie company to organize a department which should have charge of the operation, maintenance, traffic, tariffs and other features of the long-distance service. Mr. E. D. Trowbridge was appointed general superintendent of long-distance service; a superintendent of long-distance service being appointed for each of the companies controlled by the Erie company. During

the past year the work of this department has been largely along the line of getting traffic on a thoroughly systematic basis. A man who writes a letter or a telegram has no further thought about the matter after the office boy takes it out of his hands, but with a telephone message he frets until the call has been "delivered." While the operators in the exchange, on the long-distance boards, at switching stations and at the distant exchange are going through the necessary motions of work to get the call through, to the subscriber every second seems a minute and every minute an hour. Consequently every possible effort has been made to eliminate all unnecessary delays, not only from the subscriber's standpoint, but also from a standpoint of the economical use of circuits.

The long-distance lines of the Erie system may be said to be operated on the following general principles:

1. The telephone furnishes a means of rapid and satisfactory communication, and the company is selling a service which can be used to a great or small extent by every subscriber. The first requisite, therefore, is to know the subscriber's needs, and to plan, primarily, to meet his wishes.

2. The business which the subscriber will do is limited only by his means and by the results he gets—that is, the quality and speed of the service. The rates, therefore, must be as low as is consistent with good service. The service must be rapid.

3. To get mutually satisfactory results, the subscriber must know how to use the telephone to best advantage; in other words, the subscriber must be acquainted with the possibilities of the telephone. So far as possible, the subscriber must be educated in the general working of a telephone system, so that he will take sufficient interest to study, on his part, the reasons for delays or for the seemingly endless lot of things that happen "at the other end of the line." Once he grasps the general scheme, he will make intelligent effort to explain his troubles and to avoid, on his part, introducing future complications. His complaints, in place of being in the nature of general "roasts," become of the greatest assistance in clearing up troubles.

4. The rules for the government of operators and the general conditions governing the service must be so laid out that the subscriber can always get a prompt answer to any question he may ask. The rules, therefore, while explicit enough to cover all probable cases, must be flexible enough to permit those governed to exercise judgment in the handling of business, the main point being "to get calls through," not only for the sake of the subscriber, but for the sake of the particular message in question, as well as for future business. In other words, those concerned with the handling of the service should follow the rules closely, but in case of any doubt should see that service is given, and that discussion of the matter shall be held after the subscriber has been attended to.

That the general policy outlined is one that is mutually satisfactory to the subscriber and to the company, is clearly

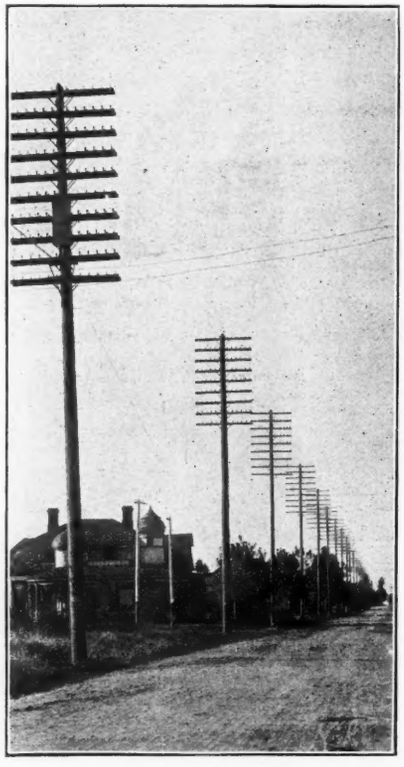


FIG. 4.—BELT LINE FOR LONG-DISTANCE CIRCUITS AT DALLAS, TEX.

demonstrated by the fact that in the past year an increase of 40 per cent has been made in the long-distance earnings of the Erie system—an increase which is unprecedented. The service has been popularized, the subscriber has been pleased, and the company has a remarkable increase in revenue to show for it. The result has been accomplished by a careful study of the operating; by having a force of men whose business has been to keep in touch with the subscriber's needs and to keep the subscriber posted on the details of his own business; by introducing new operating methods as fast as the increase in traffic necessitated; and by keeping the public at large informed, by advertising, etc., on all changes or improvements which were calculated to encourage the subscriber to use the service. Handling the heavy cotton business in Texas, the wheat traffic in Minnesota and the Dakotas, the manufacturing trade in Wisconsin, the ore and shipping in northern Michigan, and manufacturing, lumber and general trade in the southern peninsula of Michigan, the Erie system includes, among its subscribers, representatives of all industries, and its operating service has been planned with particular reference to local conditions. Keeping closely in touch with the business, the company has, by furnishing additional facilities of changing its operating arrangements, provided for the increase in traffic in the various sections of its territory. It is a source of considerable satisfaction to those in charge of the service to know that, in spite of the phenomenal increase in the business, the traffic in 1900 has been handled with a smaller percentage of "lost calls" than in 1899.

A plan was devised some months ago for charting the company's traffic. Charts are made periodically, and show, at a glance, the total amount of traffic passing over a given route, or over any particular section of a route. These charts form an accurate basis for determining the needs for additional circuits on existing lines, and consequently result in an economical distribution of lines. With the unusual increase in traffic in the past year this plan has proved extremely valuable, as it has enabled the company to keep pace with the needs of the service. Where unusual delays were reported a glance was sufficient to determine whether or not there were ample facilities on the route in question. If the traffic chart showed that, under normal conditions, the circuits should handle the business, a detailed investigation was made to ascertain if the trouble was due to operating or to improper arrangement of the circuits. In several cases the charts showed that, with the heavy increase from month to month, the increase had not at all been evenly distributed and that an arrangement of lines which was satisfactory in one month was rendered useless a month later through a change in the direction of traffic.

The pole lines of the Erie system, counting only those used for long-distance service, have an aggregate length of 18,106 miles—a figure which gives an idea of the extent of territory covered. Twenty-eight hundred cities, towns and villages are reached by this system. The pole and wire mileage is divided as follows:

Company.	Pole Miles.	Copper Wire Miles.	Iron Wire Miles.	Total Wire Miles.
Michigan	5,708	14,637	11,134	25,771
Wisconsin	3,169	9,234	3,419	12,653
Northwestern	3,586	13,569	3,555	17,121
Southwestern	5,643	33,077	5,584	38,661
Total	18,106	70,517	23,692	94,209

Seventy-five per cent of all wire in use is of copper. Of the copper wire, 6,625 miles is No. 8 hard drawn, weighing a total of 2,881,875 pounds, and 62,643 miles is No. 12 hard drawn, weighing 11,774,596 pounds. Counting No. 9, 10, 11 and 14 copper in use—1,249 miles—the total copper on long-distance lines amounts to a trifle less than 15,000,000 pounds. There are in use 600,000 poles, which, if placed end to end, would extend across the American continent.

The No. 8 copper circuits, built by the company, furnish first-class facilities for long-haul business. No. 8 circuits have been built as follows: Detroit to Kalamazoo; Detroit to Grand Rapids; Grand Rapids to Mackinaw City, and by special submarine cable to St. Ignace; St. Ignace to Marquette and Houghton; Milwaukee to Marinette, and Marinette to Marquette; Minneapolis to Fargo; Texarkana to Pine Bluff; Texarkana to Little Rock; Little Rock to Helena; Texarkana to Houston; Texarkana to Dallas; Dallas to Houston and Galveston; Dallas to San Antonio. A pair of No. 8 wires is now being put up between Detroit and Bay City, and next year a through line, carrying a No. 8 circuit, will be built from Bay City to Mackinaw City, furnishing a direct route from Detroit to the upper peninsula of Michigan. The construction of these circuits, taken with the No. 12 copper circuits, insures the best possible service throughout the company's territory. The iron circuits built by the company are used for local traffic and for connecting up small stations located near the main trunk lines.

To further insure against poor service the company has located its operating stations at Dallas, Houston and Detroit on the outskirts of the city. In each of these cases heavy pole lines bring the circuits clear of all cable to the operating station. Direct trunks connect the long-distance station with the exchange downtown. By this arrangement all through business is handled without having messages go through a large amount of underground cable, as is the case in most large cities. Furthermore, by constructing special belt lines the usual interferences incident to city construction are avoided, and the lines come into the test panels in the operating station in particularly clear shape. The station at Detroit, a picture of which appears in the preceding illustration (Fig. 3), has just been completed. The pole line has been finished and wire is now being strung to complete the work. It is expected this station will be in operation in 60 days. The company expects, during the coming year, to erect an operating station midway between Minneapolis and St. Paul, centering the various circuits at this station.

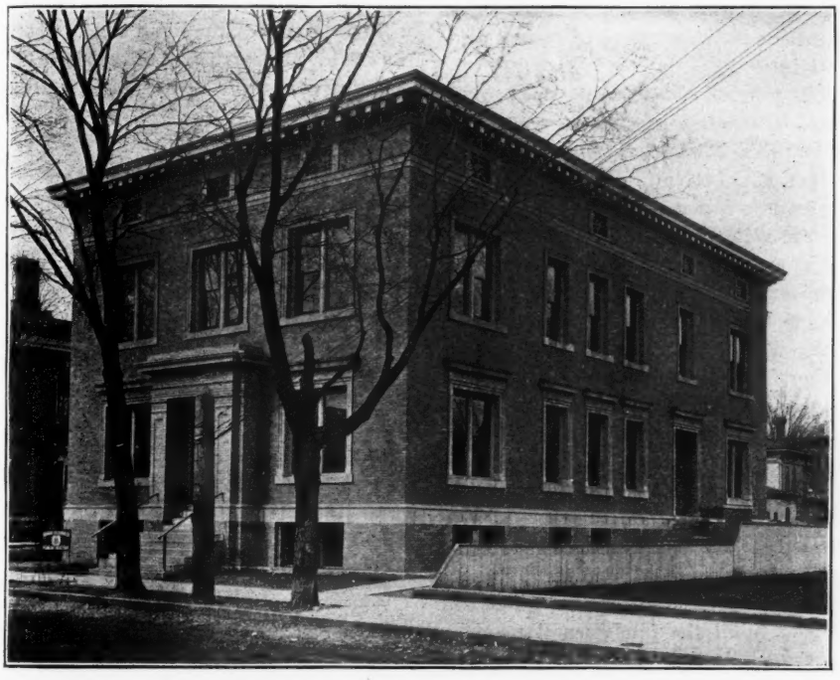


FIG. 5.—OFFICE, EXCHANGE AND LONG-DISTANCE TELEPHONE BUILDING AT KALAMAZOO, MICH.

In addition to the three buildings mentioned above, the company owns office and operating buildings in the following cities: Cleveland, main exchange and offices, Cleveland, east, Cleveland, west, and Doan branch exchange buildings; Detroit, main exchange and offices, Detroit, north, Grand and East branch exchange buildings; Port Huron, Saginaw, Jackson, Pontiac, Marquette, Grand Rapids, Lansing, Kalamazoo, Adrian and Bay City, Mich.; Milwaukee, main exchange and office buildings, Milwaukee, west and south branch exchange buildings; Madison and Racine, Wis.; Minneapolis, main exchange and office building, Minneapolis, south branch building; St. Paul, main and Dale branch buildings; Dallas, Houston, Austin, Waco, Forth Worth, Galveston, San Antonio and Paris, Tex.; Little Rock and Fort Smith, Ark. Buildings for Winona, Minneapolis, east branch, Detroit, west branch, and Grand Rapids, south and west branches, are in process of construction. Of the buildings listed 18 have been completed during the past year. Several others will be started in the Spring, so that within a year every large exchange operated by the company will be located in a building owned by the company.

These buildings having been planned and constructed for telephone purposes, make adequate provision for the long-distance service. In each building, with the exception of branch exchange buildings, a large room has been provided for long-distance operating. The accompanying picture of the new building at Kalamazoo gives a good idea of the style of construction of one of the medium-sized buildings.

While this article is confined to the long-distance features of the Erie company's territory, it will be of interest to note that the company has over 140,000 subscribers, and that, with those waiting for connection, it will close the year with over 150,000. In all large exchanges "relay" switchboards have been installed, giving subscribers the benefit of the highest grade of telephone service. During the past year a vast amount of work has been done in connection with placing wires underground in all large exchanges. The year has been a remarkable one for the company in every way—in the improvement of its long-distance and exchange service, in the extension of exchange and long-distance lines, in the construction of new aerial lines and the general extension of underground conduits, in the engineering of switchboards and apparatus for two-thirds of its larger exchanges—all combining to place the company in a stronger and better position than ever, both in point of immediate results and with a view to future growth and extension.

The telephone business is a business of endless detail—more so than any other business handled on a large scale—and the amount of work undertaken and carried through by the Erie company in the last year forms one of the remarkable chapters

in a remarkable industry. President Glidden and his associates have every reason to be proud of the results attained.

The Erie company's executive offices are located at Lowell, Mass. The headquarters of the construction, equipment, contract and long-distance departments are in Detroit. Those in charge of the operation of the plant are: Charles J. Glidden, president; Charles E. Adams, J. P. McKinstry and H. J. Pettengill, vice-presidents; George B. Perham, secretary; C. A. Grant, treasurer; P. G. Reynolds, general superintendent of construction; E. D. Trowbridge, general superintendent of long-distance service; C. L. Boyce, general superintendent of equipment; C. E. Nestor, general contract agent; E. W. Bennett, superintendent of supplies; T. W. Greenslitt, manager advertising department.

The organization of the companies controlled by the Erie company is as follows:

Cleveland Telephone Company: P. Yensen, general manager; Frederick Yensen, engineer; C. T. McKinstry, local treasurer.

Michigan Telephone Company: F. A. Forbes, resident director; J. F. Land, W. J. Berry, C. E. Wilde, George D. Sherman and G. E. Dutton, general superintendents; Louis Hall, assistant general superintendent of construction; P. E. Hurson, superintendent of equipment; C. O. Cook, superintendent of long-distance service.

Wisconsin Telephone Company: John D. McLeod, general manager; E. B. Cottrill, general superintendent; D. E. Roberts, local treasurer; J. A. McManman, superintendent of equipment; E. T. Jones, superintendent of construction; G. P. Robinson, superintendent of long-distance service.

Northwestern Telephone Exchange Company: C. P. Wainman, general manager; J. W. Christie, general superintendent; W. F. Fox, superintendent of long-distance service; Thomas Dwyer, superintendent of construction; Benjamin Waller, superintendent of equipment; A. C. Whidden, local treasurer.

Southwestern Telegraph and Telephone Company: J. E. Farnsworth, general manager, North Texas division; E. K. Baker, general manager, South Texas division; T. L. Powell, general manager, Arkansas division; T. W. Milburn, general superintendent, North Texas division; J. E. Jeavons, general superintendent, South Texas division; G. W. Foster, special agent; C. A. Gates, superintendent of long-distance service; S. P. Grace, superintendent of equipment; B. H. Johnston and D. McReynolds, superintendents of construction.

THE ALTERNATING-CURRENT ARC.—I.*

BY C. WILER.

The advance in the art of alternating-current arc lighting during the last two years has attracted the attention of engineers and central station men throughout the country.

The arc lamps and their movements have been described in various papers, the devices for operating large numbers of lamps in series have been set forth, and indoor as well as outdoor illumination from alternating arcs has been a topic of discussion in the meetings of various associations.

The physical nature of the open or enclosed alternating arc has been a salient factor; this, however, is the key for many phenomena of the arc. If we establish an arc between carbon electrodes, we find that the arc voltage increases with the length of the arc; if we keep the arc length constant and increase the current the arc voltage begins to decrease with the current. The apparent resistance of the arc is, therefore, unlike a wire resistance, which requires a higher electro-motive force with an increase in current, but it decreases with increasing current, so that an arc on a constant-potential circuit takes a constantly increasing current. In order to offset this tendency, a steadying device is required, which does not depend for its resistance upon the current and which will thereby fulfill the fundamental requisite for the application of the arc to lighting purposes.

On a constant-potential circuit a series resistance or series reactance will render the arc stable. The larger the resistance, the less the variation in current and the steadier the arc. On a constant-current circuit, where the arcs are connected in series and the main regulating coils offer no perceptible impedance, the dynamo or transformer decreases the terminal pressure with increasing current. The more drooping the characteristic or the relation of current and electro-motive force on the dynamo or transformer for either fixed brush position, fixed position of movable coil or core, the steadier the arcs.

The resistance of a stable direct-current arc is of constant value for any particular current. The resistance of the alternating arc varies with the current.

During the first part of the positive half of the cycle the resistance drops from its maximum value at zero current to its minimum value at maximum current and rises again during the second part, so that the wave form of the resistance will describe one-half cycle of the current a complete cycle, and the resistance of the arc will pulsate at the rate double the frequency of the current.

Considering instantaneous values of the alternating arc, we may take it for granted that the law of the direct-current arc can be applied to them. The transformation of electricity into light is certainly not different for a current of momentary value than from that for a current of continuous value. Hence, during the positive part of the cycle the upper carbon will be the seat of the light. It has been shown by exploring the distribution of potential in the direct-current arc that the larger part of the energy is expended at the crater of the arc, producing there the highest temperature, while the smaller part is expended along the vapor column and at the negative carbon tip. For the low values of the impressed alternating electro-motive force an arc can not be formed or maintained between solid carbons, if they are separated for the full arc length, corresponding with the normal voltage. The available voltage is not sufficient to overcome the high resistance at the positive carbon tip. The current will, therefore, be zero for the low values of the impressed electro-motive force. It is only for the higher values that the current will find its path through the arc to the negative carbon. After the current and electro-motive force have reached their maximum values, the current will gradually drop and either fall off very abruptly near the zero line or cause a rupturing of the arc. As soon as the negative cycle starts, a shifting of polarity will take place, so that the lower carbon becomes positive and the upper negative, whereupon the same cyclic variation will be repeated. During the larger part of the cycle the current is zero or very small and the arc tends to extinguish. This action takes place when an alternating arc is to be maintained between solid high-voltage electrodes; it clearly demonstrates that the attempts which have been made from time to time to operate open alternating-current arcs with solid carbons conflicted in their very beginning with the laws of nature, and it shows also that the enclosed arc between solid carbons, which has a much larger resistance in the vapor column than the open arc, is bound to be a failure.

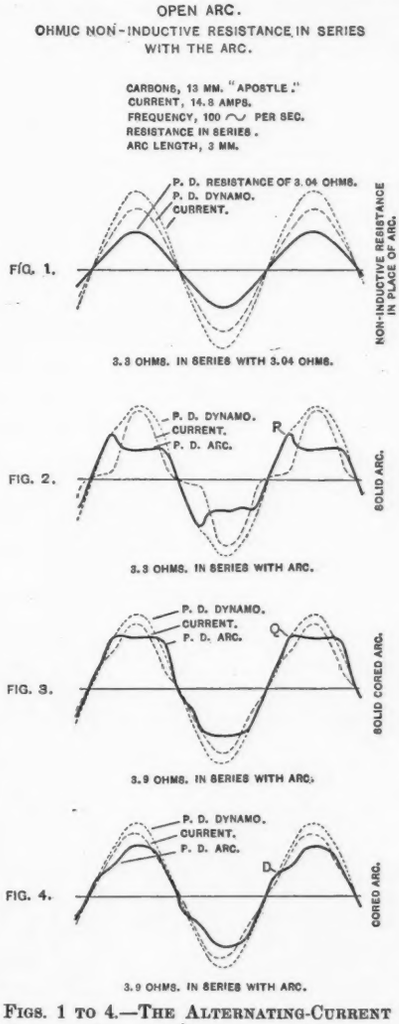
The effect of the cored carbon upon the alternating arc can be explained by comparing it with the liquid, whose resistance is lowered by the insertion of salts, and whose transitional resistance at the elec-

* A paper read before the Chicago Electrical Association, October 19, 1900.

trodes is changing therewith. For low-voltage carbons, whose core contains the salts of sodium or potasium, a large electro-motive force is not required to overcome the resistance at the crater as the core and the surrounding gases of high conductivity will not then offer a very high resistance to a current of low value, and they will offer but a small resistance to a current of high value. The resistance of the arc under these conditions is so modified that it acts more like an ohmic resistance and the current and voltage rise and fall in unison. This has been recognized for several years and the success of open alternating-arc lamps in Europe is due to the high grade of cored carbons, which meet the inherent defects in the arc. It is apparent, that an open alternating-current arc between two cored carbons will not require a large amount of steadying resistance on account of the characteristic just mentioned. It is surprising, however, that only a short time ago M. Blondel stated at the Paris congress: "The alternating-current arc requires less stability resistance because of the greater sensibility of its mechanism under influence of vibration." Whatever resistance is required by an open alternating-current arc between cored carbons is necessary at the moment, when the current is near its zero value, when the polarity of the carbon reverses and the arc stream changes its direction. It is a matter of experience, and also borne out by theoretical investigations, that this is better accomplished by a small inductive resistance than by an ohmic resistance. The electro-motive force of the latter will vanish with the current, while the leading electro-motive force of the former will be ready to help the lagging current over the zero point or the dead centre of the arc. It is here that the effect of what may be termed the "momentum of the arc," *i. e.*, of the frequency, becomes plainly visible. The higher the frequency, the quicker the change in the polarity of the carbons, the shorter the time during which the current is of small value and the carbons and the arc can decrease their temperature and by their increasing resistance oppose the establishment of an arc. We might expect from the foregoing that a low-frequency arc is less efficient than a high frequency one; but Blondel has shown that for open alternating-current arcs the opposite is the case (*Electrical World,* Vol. XXIX.—Luminous Efficiency of the Alternating-Current Arc). He attributes this "to the greater distance between the carbon points that is realized for the same voltage at high frequencies."

The effect of the frequency and the conductivity of the arc stream is of the greatest importance for the starting and controlling of arc lamps, and many problems met in practice can be considered and solved accordingly.

The study of the alternating arc in the past has been mostly pursued by obtaining the wave forms of the current and electromotive force through the slow tedious contact method. Of late the more rapid and accurate oscillograph method has been applied by Messrs. Duddell and Marchant, and the results have been communicated to the Institution of Electrical Engineers, London (*Journal of the Institution of Electrical Engineers,* Vol. XXVIII, London). An oscillograph is a galvanometer, whose deflections are proportional to the instantaneous value of the current; a mirror attached to the movable part reflects a beam of light upon photographic plates, so that a continuous record of the wave form may be obtained. By employing several instruments the wave form of the current, the wave form of the potential difference of the arc, and of the dynamo, can be traced simultaneously and effect of changes in any of the waves can be recorded and noted. The curves obtained by Duddell and Marchant are undoubtedly the most interesting and accurate known. In Figs. 1 to 10, curves as obtained by them on a 100-cycle alternator with small armature self-induction are referred to.



FIGS. 1 TO 4.—THE ALTERNATING-CURRENT ARC.

Fig. 1 shows the wave forms of the potential difference of the dynamo, the current and the potential difference across an ohmic non-inductive resistance of 3.04 ohms in series with 3.3 ohms. Current 14.8 amperes.

In Fig. 2 the energy taken by the resistance of 3.04 ohms has been replaced by an open arc between solid carbons, adjusted for the same current, 14.8 amperes. Length of arc three millimetres. Steadying resistance same as in Fig. 1. Arc voltage 53.2. Power factor .74. For the low values of the available voltage at the arc the current hardly begins to rise, so that the potential-difference arc wave runs up very abruptly, until it can get the current through the arc, thereupon it decreases again and stays nearly constant until the decrease in current produces a slight rise. The waves of current and the potential difference at the arc appear, therefore, considerably distorted from Fig. 1. The front peak in the potential difference at arc wave is very much more pronounced than the back peak, which finds its explanation in the well-known fact that an alternating-current arc is easier to maintain after the carbons have been heated and their conductivity raised than in the cold state.

In Fig. 3 the lower carbon has been replaced by a cored carbon. The arc length and the current are kept constant for all experiments on open arcs. The arc voltage is reduced to 37.4; the power factor of the arc increased to .94. The front and back peaks on the potential difference at arc wave have disappeared.

In Fig. 4, top and bottom carbons are cored; arc voltage 32; power factor .99. A comparison with Figs. 1 and 2 shows that the waves are not very much distorted and that the arc resistance has undergone a complete change.

Fig.	Carbons. Top.	Carbons. Bottom.	Resistance in Series. Ohms.	S. I. in Series. Henrys.	Impedance of Inductance Coil. Ohms.	P. D. Arc. Volts.	Power Arc Watts.	Power Factor. Arc.	Notes.
1	3 04 Ohms in Place of Arc.		3.3	Very Small.	.....	45.1	666	1.00	To be Compared with Fig. 2.
2	Solid.	Solid.	3.3	"	.....	53.2	581	0.74	Slightly Hissing.
3	"	Cored.	3.9	"	.....	37.4	521	0.94	Not Hissing.
4	Cored.	"	3.9	"	....	32.0	470	0 99	"

ELECTRIC TRACTION ON THE NEW YORK ELEVATED RAILWAYS.

FIRST TRIPS OF ELECTRIC MOTOR TRAINS OVER THE MANHATTAN RAILWAY COMPANY'S ELEVATED STRUCTURE IN SECOND AVENUE, NEW YORK CITY.

The official trial of the new electric traction system of the Manhattan Railway Company, more familiarly known as the elevated railroad, in New York, was made on Thursday, November 22, 1900, on the Second avenue division, between the Six-

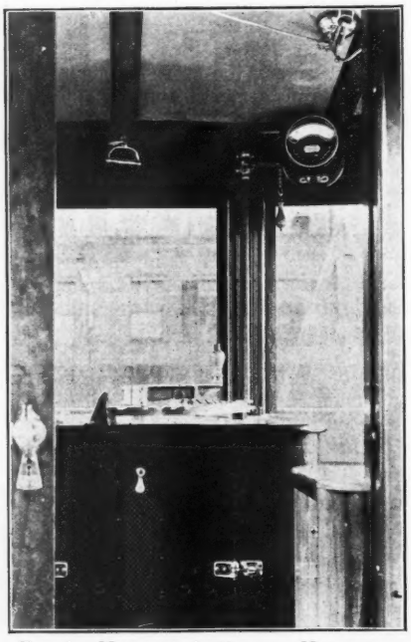


FIG. 1.—MOTORMAN'S CAB ON MANHATTAN ELEVATED RAILWAY ELECTRIC TRAIN.

ty-fifth and Ninety-second street stations. A considerable number of invited guests were present to inspect the operation of the train, which made numerous trips between the points mentioned.

The trial train, which is a specimen of the trains that will be put in regular service, greatly resembles the trains now drawn by steam locomotives, except that the cars are noticeably wider and seem roomier in their interior arrangements. The same length of car and style of platform and coupling are used, and the electrical connections as described below are such that trains of any number of cars, from one up, may be operated—always with a single controller.

The motor cars are placed at each end of the train, though doubtless three-car trains may be operated with a single motor car. The motor car in all respects resembles the ordinary passenger cars, except that about five feet of one end of it is boarded off with a glazed partition, converting this into a cab, wherein is located the controlling machinery and the air-brake pump. At the front, or cab end, the platform is omitted, this end of the car having its corners cut off and being fully glazed in front, giving the motorman an excellent view of the track and signals ahead, while, at the same time, fully protecting him from the weather. The frame of the motor car is strengthened by steel I-beams from end to end, and upon its trucks are mounted four motors, one on each axle; these machines are of the single-reduction-gear type, with gearing running in oil, and develop, under normal maximum consumption of current, 150 horse-power each, thus giving the motor car 600 horse-power, or 1,200 horse-power for the two cars which are provided for each train. Like all the rest of the electrical apparatus used on these trains, the motors were supplied by the General Electric Company, of Schenectady, N. Y.

The third rail, as has been described before in the ELECTRICAL REVIEW, is a special-rolled, high T-rail, made of a steel of composition especially selected for its electrical conductivity. These rails are made in 60-foot lengths, and are provided with two holes in the web, and two holes also in the foot, near each end, for the attachment of flexible copper bonds, each of which is about 500,000 circular mils in section. As there is little or no mechanical strain on the third rail, one bolt in each rail end serves sufficiently to connect the two together. These rails are mounted upon large cubical-shaped insulators, made of a material called "reconstructed granite," which is said to possess great mechanical strength and to resist the action of freezing, grease, acid, vapors, etc. The third rail is further protected from mechanical injury and put out of the way of the stray passerby by being enclosed between boards two inches thick, which come up on each side to some distance above its head, thus making it not easily possible for workmen or others walking on the tracks to touch the rail except by intention.

Upon this rail runs a shoe of cast iron supported by two toggle links attached to the framework of the truck of the motor car. Each truck of each motor car carries one of these shoes on each side, so that whichever direction the train may run in, at least four shoes normally bear upon the third rail, while gaps in the latter as long as the extreme distance between the end trucks of the train may be crossed without loss of current.

The method of control adopted is exceedingly simple, and, apparently, highly efficacious. The four motors on each car are normally connected together in multiple, and under each motor car is a resistance, solidly constructed of sheet metal embedded in asbestos. The controller operates first by throwing the groups of motors on the two cars in series with one another and with the resistance, then cuts out the resistance progressively, finally shifting over so that the two sets of motors are in parallel with one another, and also in series with the resistance. The last steps for high speed cut out the resistance altogether and leave all the motors connected in parallel. It will be readily seen that this system of connection requires only one conductor connecting the two motor cars. Hence the wiring of the intermediate passenger cars consists simply of a straight conductor through them and flexible conductors between cars. Another cable is also led along the train for furnishing current to the electric lights in the cars and the electric heaters of the Gold pattern, which are placed under the seats. The lighting of

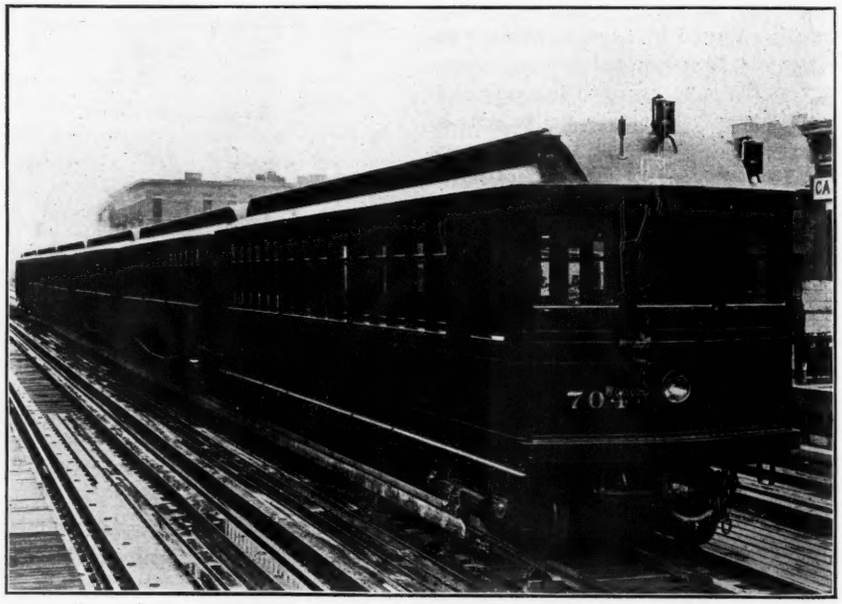


FIG. 2.—SIX-CAR ELECTRIC TRAIN OF THE MANHATTAN ELEVATED RAILWAY.

the cars is accomplished by 20 lamps in each car, 10 on a side, these being in the slant portion of the roof between the window frames and the monitor—in other words, just over the heads of seated passengers. By this simple arrangement, even when passengers are standing in the aisles, they will not cast their shadows upon one another, so that those fortunate enough to have seats are not compelled, as at present, to sit in gloom unable to read their newspapers.

In the motorman's cab at each end of the train is a multipolar enclosed motor direct-coupled to a two-cylinder air-pump for supplying air to the Westinghouse air-brake system used on the train. In the cab, also, are located magnetic circuit-breakers in the main circuit, the limit switch controlled by air pressure for starting and stopping the air-pump motor, magnetic blow-out fuses, and switches for controlling the lighting and heating of the train.

FIG. 3.—RHEOSTATS AND MOTOR TRUCK, SHOWING COLLECTING SHOE, OF MANHATTAN ELEVATED RAILWAY ELECTRIC MOTOR CAR.

On the trial run the movement of the train was surprisingly easy although its acceleration was very rapid. The normal current consumption with a six-car train, somewhat lightly loaded with passengers, when running at a rate of 35 miles an hour, approached about 500 amperes at 550 volts. There was very little sparking under the contact shoes, although the third rail having been laid sometime and not being in regular use was very rusty.

Among the prominent persons aboard the train during the trial trip were Messrs. Frank Gould, President H. H. Vreeland, of the Metropolitan, and President Clinton H. Rossiter, of the Brooklyn Rapid Transit companies; W. B. Potter, of the General Electric Company; W. J. Van Dorn, Messrs. Neff, Bickel and Vogel, of the Air Brake Company, and Vice-President Alfred Skitt, General Superintendent W. E. Baker, General Manager S. D. Smith, Purchasing Agent A. E. Green, Treasurer McWilliams and Auditor E. F. J. Gaynor, of the Manhattan company. James M. Doyle, electrical master mechanic of the road, was at the lever, while on board, to see that nothing went wrong, were the four men under whose direct supervision the electrical work is being done—Road Engineer W. F. Lockwood, Roadmaster John O'Brien, Supervisor L. J. Garipey and Construction Engineer E. F. Slater.

For this official trial current was furnished from the power-house of the Third Avenue Railroad Company at Sixty-seventh street and Third avenue, the new station of the Manhattan railway not yet being ready to supply electrical energy. It is believed that the whole system can be in operation by the Autumn of 1901, the only delay that may be serious being the completion of the power-station. All the apparatus for this station has already been ordered, and much of it is nearing completion, while the station building itself, with its four high brick chimneys, is also well underway. The greatest credit is due to Mr. W. E. Baker, electrical superintendent of the railway, for the skillful work he has done in designing so simple, and what promises to be so satisfactory, a solution of the many difficulties presented in the problem offered him in the electrical equipment of these most important lines.

FIG. 4.—INTERIOR OF AN ELECTRIC MOTOR CAR FOR THE MANHATTAN ELEVATED RAILWAY—SHOWING ARRANGEMENT OF LIGHTS.

Meeting of the American Institute of Electrical Engineers.

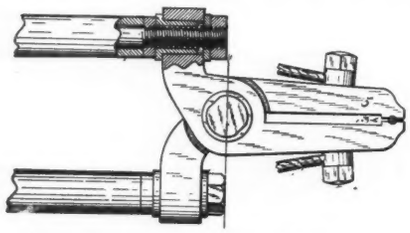
The one hundred and forty-eighth meeting of the American Institute of Electrical Engineers was held at 12 West Thirty-first street, New York, and simultaneously in Chicago, on Friday evening, November 23. About 50 members were present at the New York meeting. The first business before the meeting was a report of the Committee on the Establishment of a National Standardizing Bureau, the report being presented by Dr. Samuel Sheldon. The report urged the establishment of the bureau, and voiced the opinion of the committee that the Institute should exert its influence upon senators and representatives to hasten the speedy passage of this important measure. It was unanimously adopted.

The first paper presented was entitled "On the Mechanical Forces in Dynamos caused by Magnetic Traction," and was read by the author, Mr. B. A. Behrend. Previous to the reading of the paper Mr. Behrend exhibited upon the screen a fine portrait of the late Professor Von Helmholtz. The paper referred to the stress caused in dynamos by eccentricity of the armature, and reduced the computation of these to a matter of great simplicity by the application of a simple formula. The paper was discussed at considerable length by Messrs. Dunn, Mailloux, Floy, Henshaw and Hamilton.

The next paper was also read by its author, Mr. Henry Floy, and was entitled "The Plant of the St. Croix Power Company of Wisconsin."

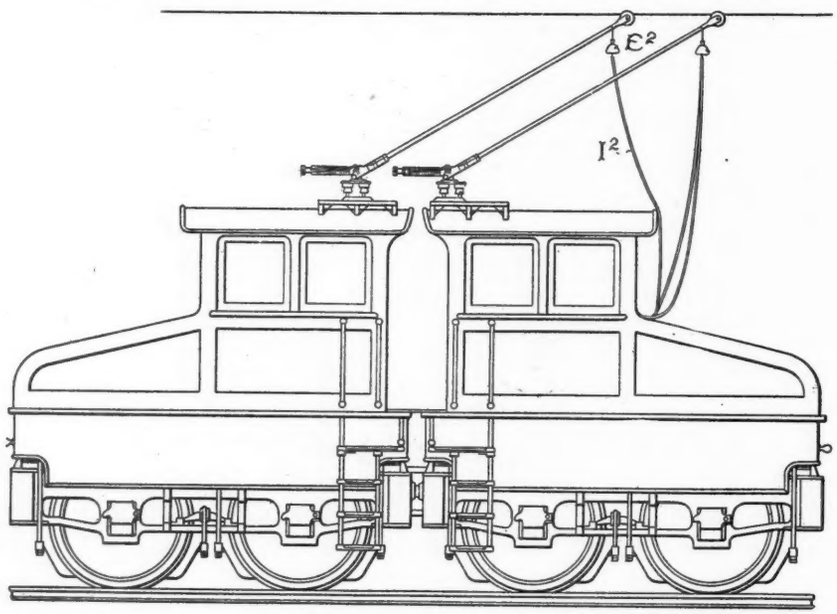
Recent Electrical Patents

A rather unique idea in the line of electric welding comprises tongs, the jaws of which are pivotally connected, but insulated from each other, and form the two poles of the circuit. Each of these jaws is provided with a handle, which is, however, insulated from it. The operation of



Electric Welding Tongs.

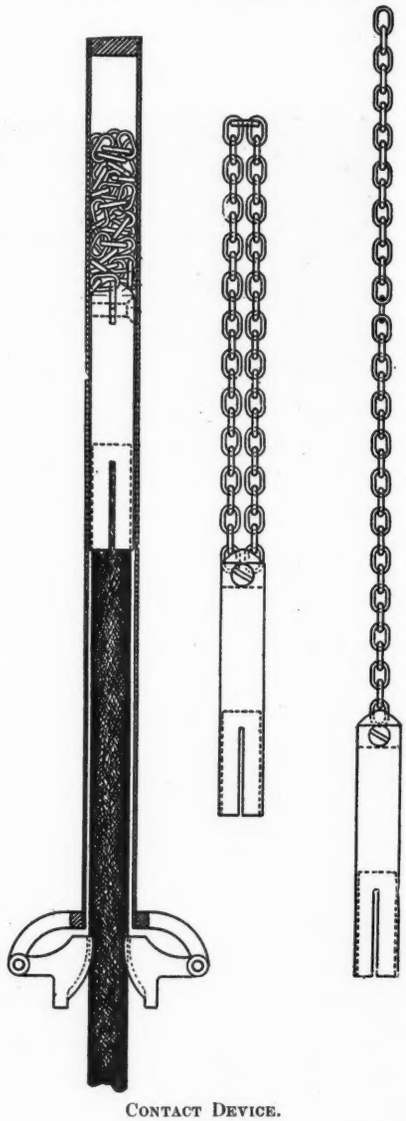
the device will be readily apparent. The pieces to be welded are placed between the jaws, which are brought together upon the same. The current will immediately pass through the articles, and will sufficiently heat them in a few seconds. The jaws are then clamped tighter together in order to compress the heated ends to effect the proper union. This is the idea of a resident of Indianapolis, Ind., Mr. John A. Duncan, who has assigned a part interest in the same to Calvin F. Darnell and C. Augustus Schmidt, of the same place.



High-Potential Trolley System.

We herewith present a cut of an exceedingly important improvement in the manner of insulating the trolleys of a high-potential system. This improvement is the invention of Mr. William B. Potter, of Schenectady, N. Y., and the patent obtained on the same is controlled by the General Electric Company. There are two important features of this invention: First, to prevent any considerable leakage or short circuit across the line; and, secondly, to arrange the controlling cord of the trolley so that the conductor is not likely to receive a dangerous shock in wet weather should it become necessary to replace the trolley for any reason. To effect the first purpose of the invention, the trolley base is insulated from the car by porcelain insulators carried on suitable supports so that the trolley base is entirely insulated. It is, of course, intended that the usual insulated conductors shall be used to supply the motors in such construction. The second purpose of the invention is effected by insulating the cord from the trolley pole by a suitable device made of substantial insulating material, such as porcelain or the compressed asbestos forms of insulation now well known. This will ordinarily form a sufficient protector, but in order that there may be no danger to the operator, the cord is formed with a metallic core, which is grounded upon the truck-frame of the locomotive, and is surrounded with suitable flexible insulation. It will be readily seen that this affords complete protection from the high-potential systems that are coming into such general use.

In order to insure a proper electrical connection between the carbon pencil of an arc lamp and the tube for the same, Professor Elihu Thomson has devised a contact device that will secure such connection. He provides a holder which is slidably mounted in the carbon tube and is adapted to be secured to the upper end of the carbon pencil. This holder has fastened to its upper end, a chain which is also arranged to slide up and down in the tube. This arrangement offers little or no resistance to the feeding of the carbon, and at the same time the chain provides a great many points of contact

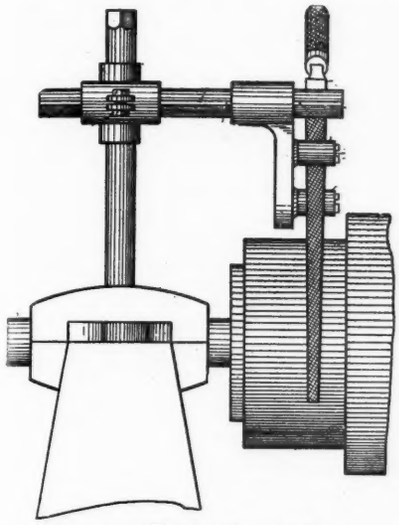


Contact Device.

against the interior of the tube. It will be readily understood that this device may be applied in many other kinds of electrical apparatus where good contact is desired between fixed and moving parts.

Mr. Percy B. Bosworth, of Akron, Ohio, has patented an ingenious little support for positioning a file upon a commutator for the purpose of truing the same. It consists substantially of an upright post adapted to be secured to the bearing of the armature shaft. This post carries an adjustable arm arranged at right angles thereto, and over the commutator. Slidably supported upon this arm is a depending bracket which is provided with a

pair of spaced horizontal rollers between which the file is intended to be placed. In operation, the several elements are adjusted until the file will be held in proper position upon the commutator which is then rotated. At the same time the file is reciprocated back and forth between the rollers. This forms a very satisfactory

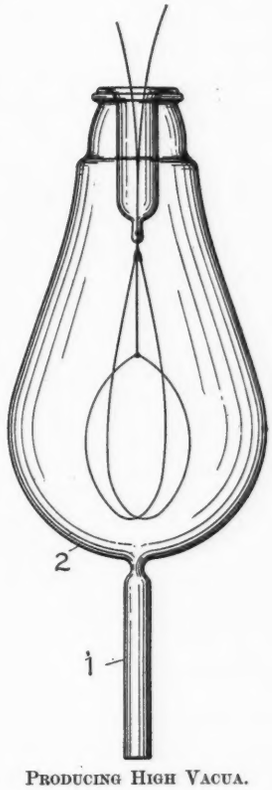


DEVICE FOR TRUING COMMUTATORS.

apparatus that may be applied to commutators of various sizes.

A novelty in electric fans has recently been patented by John T. Beswick, who resides in New York city, the object being to provide a support which will permit of an adjustment of the fan at any angle, and also provide a motor casing which will permit of the ready removal of the brushes. To carry out the first of these objects, he provides a hollow standard, the inner portion of the upper end of which is concaved and slotted at one side. The fan casing is provided with a post that projects through the slot and has an enlarged end. It will be evident that this construction will permit of the entire fan casing being rotated in any direction or tilted backward and forward, a suitable clamp being provided to hold it in its adjusted position. In carrying out the second feature, the inventor mounts the brushes upon side plates which form a part of the motor casing, but which are readily removable therefrom.

In order to produce high vacuum in the bulbs of incandescent lamps, many methods have been devised, but all appear to have some defect or another. Mr. John W. Howell, of Newark, N. J., however, claims to have provided means which will produce an exceedingly satisfactory vacuum, and it is evident that there is something in this method, as the patent he has obtained thereon has been assigned to the General Electric Company. His idea is to first produce a preliminary exhaustion by the aid of a pump, then subject the bulb to external heat to drive off any moisture deposited on the internal walls thereof, and afterwards continue the exhaustion with the filament brought to incandescence. After these steps have been taken, a determinate volume of phosphine, or phosphoreted hydrogen gas, at ordinary atmospheric pressure, is admitted to the bulb. This acts not only mechanically as a vehicle for assisting the exhaustion of the residual gases by a washing-out action, but establishes a chem-



PRODUCING HIGH VACUA.

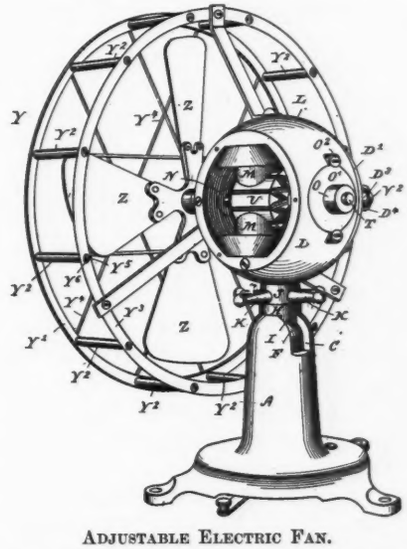
ical reaction with such hydrocarbon vapors or air as may be present, and thus effects their extraction from the bulb upon further action of the pump and exhaustion of the phosphoreted hydrogen. The result on a lamp treated according to the process is a very high vacuum and an increased output of 50 per cent in the product of an operator's work during a given period and a resultant cheapening of the cost of the lamp.

Des Moines, Iowa, is soon to have a 32-foot electric sign on its principal hotel. When this sign is erected and in operation, it will be the largest one in the West and the only one of any size which is lighted with incandescents.

Electricity in Yorkshire, England.

The United Kingdom Tramway, Light, Railway and Electrical Syndicate, of Westminster, London, England, is planning for a supply of electric light and energy, together with a street railway system, for Yorkshire. It is stated that as soon as arrangements have been made and the plans of the company perfected, the actual construction of the work will be let to the West Riding Electricity Company, whose head offices are in Leeds.

Local authorities of the various towns embraced by the proposed system have been approached by the officers of the syndicate, who claim that greater economy and higher efficiency can be obtained by their method than if a number of small companies were in operation in the various towns. As the plant will have but one head, each substation or branch in each separate town or borough being but a local tributary of the main concern, it is believed that matters can be more satisfactorily arranged and business better attended to, to say nothing of the competition which will be avoided, than if the towns were served by local companies that could not give their constituents and supporters the same high grade of service on account of a lack of capital.



ADJUSTABLE ELECTRIC FAN.

A uniform price, which will be adhered to, has been fixed by the syndicate's management, which will charge for electric lighting at 5d. per unit and at 4d. a unit for public service. Power is to be charged for at 4d. per unit during the first hour and 1d. per unit for each succeeding hour thereafter. For the street car service the proposed maximum charge is 1d. per mile for passengers, and on workmen's cars two farthings. The syndicate intends to ask additional privileges from the authorities which will enable it to carry freight and other goods at night.

MAIN LINE ELECTRIC TRACTION.

A NEW DEVELOPMENT IN ELECTRIC RAILROADING SUCCESSFULLY INAUGURATED BETWEEN ALBANY AND HUDSON IN NEW YORK STATE.

The formal opening of the Albany and Hudson Railroad and Power Company occurred on Thursday, November 22, 1900. This interesting installation was illustrated and described in the ELECTRICAL REVIEW of October 17, 1900. The visitors, numbering some 75 leading steam railway, electric railway, banking and technical men, who were invited to the formal opening, were carried from New York city in a special train on the New York Central, arriving at Hudson about 11 o'clock in the forenoon. From this point the run to Rensselaer, formerly called East Albany, was made in two of the regular cars of the Albany & Hudson Company, the distance of 38 miles being traversed in 53 minutes. The average speed was about 35 to 37 miles an hour, although on some of the long stretches the speed was over 50 miles. Notwithstanding the newness of all the equipment and most of the track, no difficulty of any kind was encountered, and no defect in operation or materials was discovered. The operation of the cars was smooth and easy, although the starting acceleration was high, and none of the unpleasant jerking, due to the reciprocating action of steam locomotives with which all of us are so familiar, was felt at any time; indeed, the smoothness of the running was one of the most noticeable features of the whole trip, and was particularly commented upon by the many steam railroad men present.

The substations were inspected, and the interesting power-house, which is regarded as an example of the most modern engineering in this line of construction was accorded much praise by the engineering and technical members of the party. The situation of this power plant is in one of the most beautiful spots in the eastern states. The scenery along the whole line is remarkable for its beauty, the fine cascade at Kinderhook Falls being visible from the track, and at various points charming views of the Catskills and of the Berkshire Hills attract the attention of passengers. Several beautiful lakes are located on or near the line, and at one of them, Kinderhook Lake, it is expected that a Summer resort will be established for the convenience of the citizens of Albany.

The cars are so constructed that both the overhead trolley and third rail connections are available, the overhead connection being necessary in the cities of Hudson and Albany. It was noticeable that there was much less noise when the third rail was in use than when the trolley was running on its wire.

It will be remembered that the Albany and Hudson railroad is the longest third-rail electric railway in the world, and the only one even approaching this size. It is operated entirely under steam railroad conditions, as regards speed, power, weight of cars, and class of traffic. The operation of the railway, however, is not the only use to which the current generated in the Stuyvesant Falls power-house will be applied, as power will be transmitted to and distributed in the cities of Hudson and Albany, and the towns of Rensselaer, Niverville, Chatham, and others along or near the line of the railway. In addition, the local trolley systems in Rensselaer and Hudson are operated by the same power, as is also the electric lighting of these and other points nearby. The same power will be available along the transmission line and throughout the valley of the Kinderhook Creek for economical application to such industries as may need it. Already negotiations are pending for the establishment of new industries to utilize some of the surplus of this fine installation.

The accompanying illustration is made from a photograph taken at the power-house, and includes a majority of the visitors. The gentlemen at the head of this enterprise are Messrs. Alden M. Young, R. A. C. Smith, H. G. Runkle and W. F. Sheehan, of New York, who purchased the water-power facilities from Mr. Charles Cooper, well known in electric lighting circles of Brooklyn. They have enlisted with themselves other progressive capitalists, and the visit on Thursday last was from a desire on their part to have the property inspected by these gentlemen, and by others who were interested.

The present officers of the company are Charles H. Werner, president; L. B. Grant, secretary; and Alden M. Young, treasurer. The general manager, Mr. Maurice Hoopes, will have his headquarters at Rensselaer, N. Y.; and associated with him as superintendent is Mr. M. E. Stark. Mr. Charles M. Heminway and Mr. M. J. Warner, of 100 Broadway, New York, are the cashier and purchasing agent, respectively.

Among the gentlemen present on the occasion of the opening were Alden M. Young, R. A. C. Smith, H. G. Runkle, and Hon.W. F. Sheehan, the chief men of the enterprise; W. H. Baldwin, Jr., president Long Island Railroad; John M. Hall, president New York, New Haven & Hartford Railroad; Colonel N. H. Heft, chief of the electrical department of the same road; Paul Wadsworth, general freight agent Delaware & Hudson Railroad; A. M. Waitt, superintendent motive power New York Central & Hudson River Railroad; James C. Irwin, engineer Mohawk Division same road; Ex-Governor David B. Hill; John B. McDonald, contractor Rapid Transit tunnel, New York city; E. P. Bryan, general manager Rapid Transit Subway Company; L. B. Stillwell, electrical director Rapid Transit Subway Company; C. A. Coffin, president General Electric Company; Charles A. Moore, of Manning, Maxwell & Moore; R. A. Cowles, of Ansonia Brass and Copper Company; B. F. Miles and Samuel Scovill, Cleveland, Ohio; S. A. Robinson, president American Bridge Company; Seth L. Keeney, Brooklyn; Geo. E. Terry, Waterbury, Ct.; Colonel William Henry White, gas engineer, New York; Colonel T. S. Williams, Brooklyn Rapid Transit Company; J. C. Breckenridge, general superintendent Brooklyn Rapid Transit Company; Charles Cooper, Brooklyn, N. Y.; Chas. W. Price, T. C. Martin, S. F. L. Deyo, chief engineer Rapid Transit Subway Company; C. M. Heminway, W. E. Crane, W. G. Bushnell, New Haven, Ct.

Many of the eminent steam railway men, and others, gave expression to favorable opinions of the installation. Mr. Baldwin, the president of the Long Island Railroad, stated that he considered it the best application of brains and money to the solution of that class of railroad traffic that had ever been presented. Judge Hall, the president of the New York, New Haven & Hartford Railroad, showed the greatest interest in every detail of the construction and arrangement of the system, and stated that he saw many features that he hoped to apply on his great system where possible. Mr. L. B. Stillwell said: "I am greatly interested in this work, and am particularly pleased to find that the single third rail is performing the functions of the trolley wire and the feed wires in the ordinary trolley system, and doing this without the use of auxiliary copper. I was also pleased to learn that the rail used was of specially high conductivity." Mr. Coffin, the president of the General Electric Company, admitted that it was not often his privilege to get away to inspections of this kind, but he was most abundantly repaid for this trip. He considered the work throughout as pro-

gressive and important as any he had seen. John B. McDonald, the contractor for the $35,000,000 tunnel of New York city, said, "Every minute of to-day has been to me doubly interesting." Mr. E. P. Bryan, general manager of the Subway company, echoed this sentiment; and Mr. Charles A. Moore spoke in the same strain, and also thought that the arrangement of the large electric crane, as well as the crane itself, worthy of special commendation. Captain William Henry White, the eminent gas and water engineer, in expressing his admiration of the water-power effectiveness, admitted to only one shortcoming, and that was that he had not mastered electrical engineering—but the captain is still young.

On the station at Stuyvesant Falls, evidently written by a previous visitor, are the following lines:

"Here we are,
Here we will stay,
Until they turn on the current and take us away."

Close of the Automobile Show, Grand Central Palace, New York.

The record of the Automobile Show at the Grand Central Palace, New York city, which closed on Saturday night, November 24, is one of excellence in point of attendance and business transacted.

Opening three days before the Horse Show the automobile exhibition naturally dragged a little until the advent of the wealthy people who came to town for the purpose of seeing the horses and who afterwards went to the Grand Central Palace to compare the horseless vehicle with the horse himself. Manufacturers whose exhibits were in both Madison Square Garden and the Grand Central Palace have stated that the crowds in the former made the successful demonstration of their vehicles less satisfactory than in the Palace, where, though the track was smaller and unbanked, it was so situated as to allow every one both on the floor and in the galleries to see everything that went on. The clear space in the centre of the track allowed fancy and trick riding; and the vehicles were able to run around not only on the track but along the main floor of the auditorium and in the side halls, thus showing what they could really do when handled properly in a crowd and under adverse circumstances.

In point of attendance Saturday was about the best day the show had, the people beginning to pour in early in the afternoon and continuing right along in a steady stream until about 10 o'clock in the evening. Even between six and eight, which is practically New York's dinner hour, there were plenty of interested spectators. Among visitors to the show who attracted considerable attention were President A. R. Shattuck, of the Automobile Club of America, who was accompanied by Mr. George F. Chamberlain, recently acting president of the club. Fred Titus, the bicycle rider, and Pol Pons, the French wrestler, spent several hours among the exhibits and appeared much interested. They said that the American electric vehicles appeared to them lighter and of more elegance in construction than the French.

The events of Saturday night included a pursuit race between two electric machines of the same make, which made it a contest between the operators in taking the corners; an exhibition mile on a motor bicycle, the operator receiving considerable applause for his performance, and the running off of the tie in the slow race that was made on Saturday night, a pearl studded scarf pin being given as a special prize for the latter from the management.

An incident of the show of rather a pathetic nature occurred on Saturday. A gentleman about 70 years old with an invalid wife and her attendant, came all the way from Elmira, N. Y., in order to select an automobile in which the lady might take a daily airing. He said that he believed a motor vehicle with a competent man to manage it would be less trying to her nerves than the customary carriage drawn by a horse. Taken altogether the show may be considered an entire success and both the management and exhibitors seem to be well pleased—especially the latter, as an unusual number of vehicles were sold during the show.

GROUP OF OFFICIALS AND GUESTS PRESENT AT THE OPENING OF THE ALBANY & HUDSON, N. Y., RAILWAY AND POWER COMPANY.

This sentiment was toasted on the return trip (refreshments from Delmonico's being served on the special train), and all agreed that the current had been turned on successfully, and everybody could be carried away easily, comfortably, and economically, by means of electricity.

Factory to Be Built at East Orange, N. J.

Conditional upon the reelection of President McKinley, contracts were let by the Morris Electric Company, of New York, for the erection of a large factory for the manufacture of street cars and electrical supplies. The site for the plant was selected about two months ago, and shortly after election active operations were commenced.

The gross receipts of the Southern Ohio Traction Company, which operates between Cincinnati and Dayton, for the six months ending November 1, were $171,040.62 and the net earnings $88,076.69, leaving a surplus, less interest, of $42,406.95.

Automobiles

The gold medal of the Chicago *Inter-Ocean* has been awarded to Mr. C. G. Ridgeway, of the De Dion-Bouton "Motorette" Company, of Brooklyn, for his 1,600-mile trip from New York to Chicago, which was made in record time, with no accidents.

A gentleman in New York who owns an electric vehicle stated recently to a newspaper man that he had driven his machine 25,000 miles with only one breakdown, and in that instance the mishap occurred within a quarter of a mile of his own house, which certainly speaks well for the machine in question.

Emperor William, of Germany, is said to have stated that he will give prizes of 50,000 francs ($10,000) for a Paris-Berlin automobile road race, and that M. Le comte de Talleyrand Perigord, vice-president of the German Automobile Club, has been appointed to cooperate with the Automobile Club of France in arranging the necessary details.

Among foreign events of interest to automobilists during the coming season are the National Cycle Show, at the Crystal Palace, London, England, which takes place from the 23d of this month to December 1, and the Turin meeting of the automobile clubs of Nice and of Italy in Turin, April 15 to April 19, and the "Tour d' Italie" from April 21 to May 9.

An Italian report states that the police department of Rome is soon to have a squad of motor vehicle policemen. Just what the details of the scheme are is not known at the present time, but such an addition to the police force of that city will be an interesting though somewhat novel experiment. Unless something unforeseen happens it may reasonably be supposed successful.

Chicago's city engineer, who is a member of the automobile examining board, states that he has had reported to him so many cases of *chauffeuses* in the state of Illinois to operate without proper licenses that he will arrest on sight any lady found driving her machine without the proper authority, or in any case if she has not a license badge in her possession when apprehended.

An interesting feature in insurance matters is the probable establishment of automobile accident policies for fire losses. Many serious accidents by fire have occurred from the careless handling of motor vehicles whose power is furnished by gasoline or other volatile oils, but it is pleasant to record that such mishaps are growing fewer as the vehicles grow in popularity and the public becomes more accustomed to their use and methods of operation.

A cable from Paris says that on November 8 the crowds attracted to the automobile fête at the Exposition were enormous, although five tickets were charged for admission. To all those who paid that price between one and three in the afternoon tombola tickets were given for prizes which included automobiles, but as these became exhausted by half-past two the crowd grew indignant and street venders quickly seized the opportunity to sell tickets for exactly six times their proper price.

It is stated that the Automobile Club of California, with headquarters in San Francisco, is the pioneer organization of the Pacific Coast, and is working vigorously to make the pastime of automobiling a popular sport there. Mr. S. D. Rogers, the club's president, has recently returned from the East where he has spent considerable time investigating the methods and forms of organization of the prominent clubs, which he submitted in his report on returning, with a view to improving the present condition of his own club. Mr. Rogers's report was received favorably and it is thought by the officers of the organization that considerable good will come of it.

An English gentleman recently attempted to bring his automobile into the port of Constantinople, Turkey, and was refused admission for it on the ground that such machines were dangerous and might contain infernal machines, dynamite or other compounds of which the Sultan is very much afraid. This is only a piece of marvelous stupidity of Turkish rule, but while discussing the subject it might be well to add that the roads in Turkey are abominable, most of the travel being conducted on mule-back and by ha mals (porters), who carry the major portion of travelers' luggage up the steep hills in Pera and Scutari. The streets themselves, when they are paved at all, are wretched pieces of work, done in lumpy, uneven cobble stones which would rack the strongest machine, and where they are not paved the ruts are so deep in many instances that wheels disappear to the hubs, to say nothing of hills whose pitch is alarming, many of them having a drop of over four inches to the foot, and alleys barely wide enough for two men to pass each other. Under such circumstances the practicability of automobiling in the Turkish Empire is almost a minus quantity and while no one on this continent can have very much patience with the Turkish administration, it may readily be seen that the use of the machine would be attended with difficulties so great as to be almost insurmountable. In case of accidents there are no repair shops and no means of obtaining supplies, for the Turk is not a mechanic and has no desire to either see, hear or feel any of the strange western inventions, which to him savor of the powers of darkness.

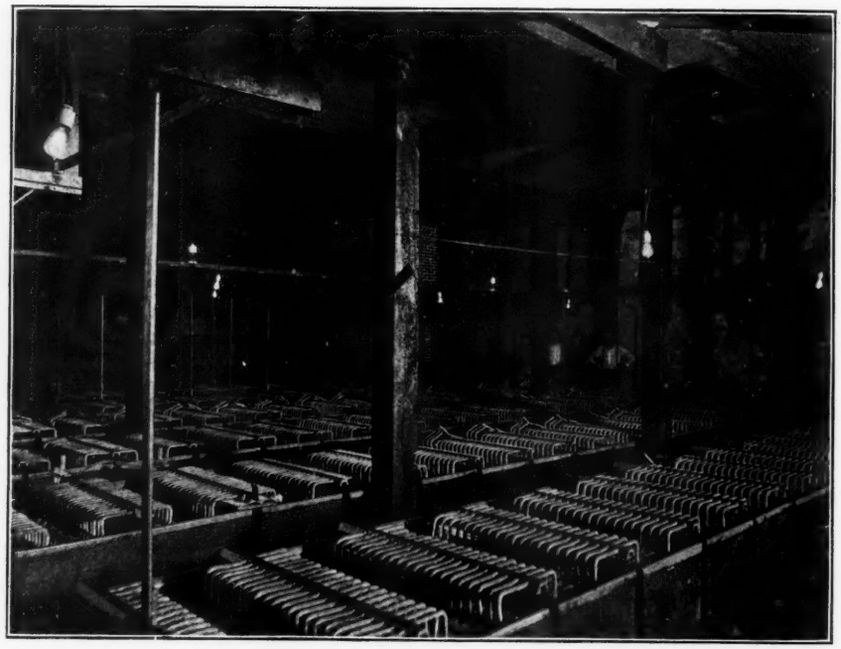


FIG. 1.—BATTERY ROOM OF THE KANSAS CITY, MO., ELECTRIC LIGHT COMPANY.

A Fine Storage-Battery Installation for the Kansas City Electric Light Company.

A new storage battery has just been installed in the central downtown station of the Kansas City, Mo., Electric Light Company, near Seventh and Wall streets. The battery is connected in two sets on the two sides of a three-wire system, working at 110 volts on a side and has 800 ampere hours capacity on a one hour discharge-rate for each side. The cells are 140 in number, connected 70 on a side, of which 20 on each side are end-cells used for regulation. The elements consist of 20 positive and 21 negative plates in each cell, each 9 by 14½ inches, the containing vessels being wooden tanks 44 by 18½ by 19 inches in size and lead lined. The cells are set up on a vitrified brick floor and supported on porcelain knobs.

In the accompanying illustrations an excellent view is had of the end-cells, switches and switchboard, and of the battery room. The latter is situated over the boiler room of the plant and, to avoid any possibility of leakage, the floor under the vitrified bricks mentioned above has been covered with sheet lead three-sixteenths of an inch thick, the joints having been burned together so as to make a liquid-tight floor, this being, of course, properly drained to the sewer.

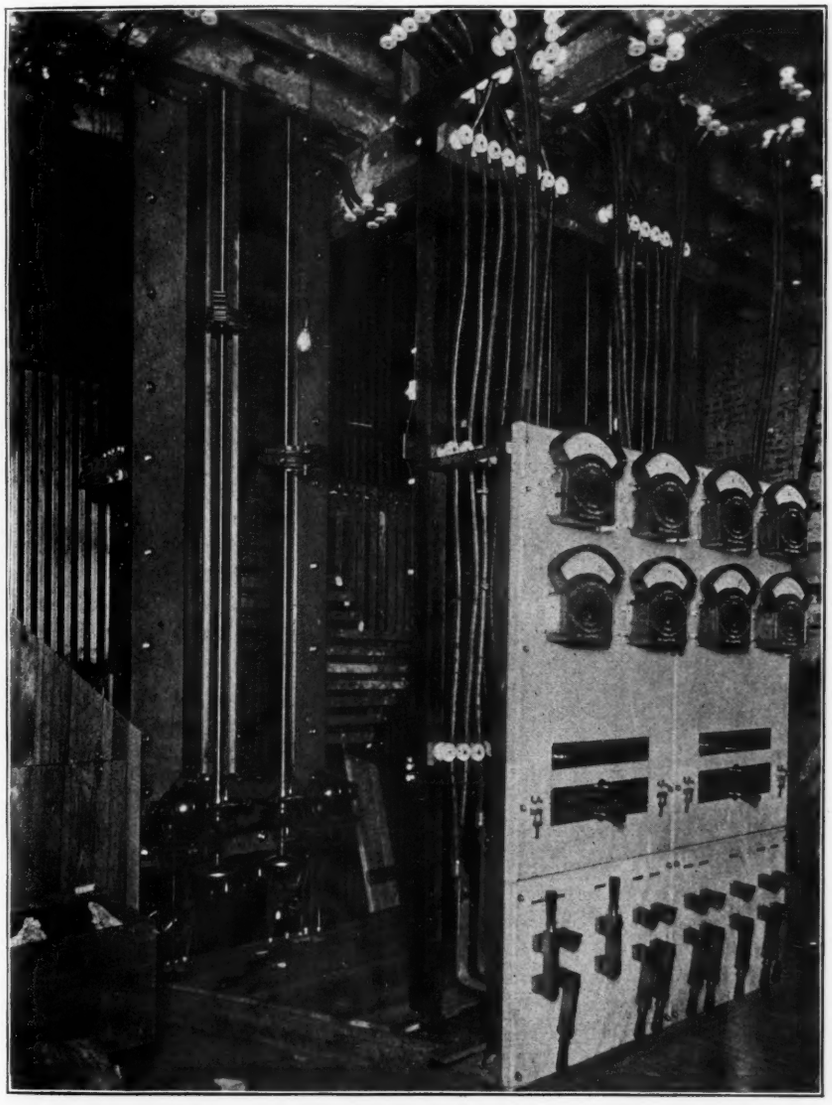


FIG. 2.—PART OF THE STORAGE BATTERY SWITCHBOARD OF THE KANSAS CITY, MO., ELECTRIC LIGHT COMPANY.

The cells are of the Helios-Upton type, and the whole installation was put in by the Helios-Upton Company, of Peabody, Mass. As is well known, the plates of this cell are of the chemically formed variety, the plates being deeply grooved and the active material filling the grooves. The open-circuit voltage of the cells is from 2 to 2.2 volts on open circuit, and from 2 down to 1.8 volts on discharge, while the "floating" voltage, when the cells are simply multiplied across the feeder bus-bars, is about 2.5 volts. After installation the cells require something like 24 hours' charging and discharging to bring them up to their normal output and activity.

Between the end-cells and the switchboard, shown in Fig. 2, the connections are made by copper bars two by three-eighths inches in size, each bar being lead coated. The switches for operating the end-cells were designed by Mr. Thomas Spencer, the general superintendent of the Helios-Upton Company, and are so arranged that some of the end-cells may be charged while the battery is in service. Ammeters and voltmeters are provided on the switchboard for both charging and discharging circuits; also differential ammeters for use in the main circuit and a voltmeter for the same purpose. There is also an ammeter for indicating the charge when end-cells are separately charged, and a low-reading voltmeter by which the voltage of any single cell of the installation may easily be read. The end-cell switches are operated by Lundell motors, shown in the background of Fig. 2, the position of the switch being indicated by a pointer on the switchboard, shown on the horizontal spaces under the meters in the same illustration. The whole installation reflects great credit upon its manufacturers and upon Mr. George E. Brett, under whose supervision it was installed. The battery will probably be able to carry the extreme peak of the load for about two hours on Winter evenings.

Electric Light Station on the Congo River.

Father Gambier, head of the Roman Catholic Mission of Luluabourg, situated on the banks of the Lubia River, which is a tributary to the Congo, is now on his way to his parish, taking with him a dynamo, turbine and all the necessary apparatus for a complete electric lighting station, which he will install there on his return. The power for the plant will be generated by a fall in the river and will furnish enough current to operate 100 incandescent and three arc lamps. Much of the machinery is of French construction, and the plant, when completed, will be the first one of its kind in the Belgian Congo district. The waterfall which will operate Father Gambier's turbine has a drop of about 28 feet, and, as the natural conditions are very favorable for such an enterprise, it is thought that the scheme will prove successful.

A Fire-Alarm System Without Batteries and Without Contacts.

As every one knows who has had practical experience with fire-alarm circuits and apparatus, the principal difficulties that are encountered in the maintenance of such a system are those having to do with the battery and with the keeping bright and in working order all of the innumerable contacts met with in the ordinary system. To avoid these difficulties has been for some time the desire of inventors and engineers having to do with municipal apparatus, and the mechanism illustrated in the accompanying engravings is intended to work without the use either of contacts or of batteries

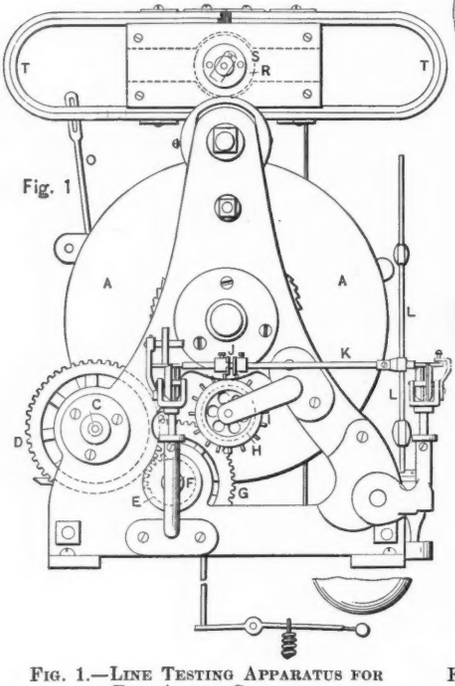


FIG. 1.—LINE TESTING APPARATUS FOR FIRE-ALARM CIRCUIT.

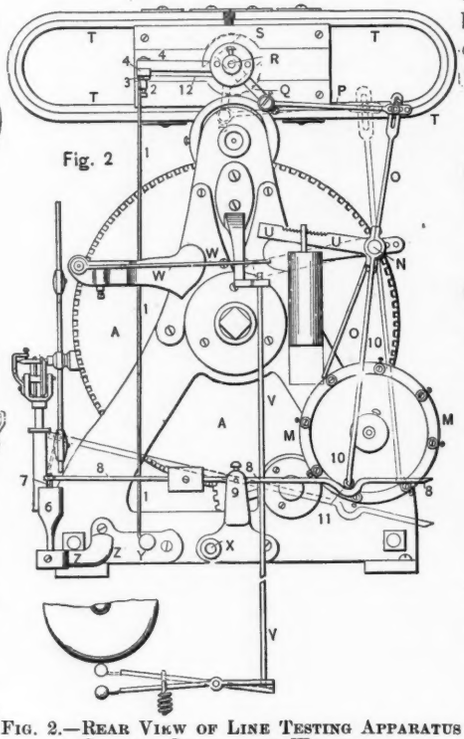


FIG. 2.—REAR VIEW OF LINE TESTING APPARATUS —SHOWING LEVERS AND WEIGHT.

of any kind. It is the invention of Mr. L. G. Woolley, of Kenton, Ohio, also well known as the inventor of the cigarette-making machine, the locomotive electric headlight, etc., and is manufactured by the National Magneto Electric Telegraph Company, of Springfield, Ohio, and New York.

The nature of the system may easily be understood from the illustrations, which represent the line-tester and a repeating station. Its operation depends upon the fact that a sudden rapid single half turn of an ordinary single coil magneto armature in the field of a powerful magnet sends out upon the line connected with it a current impulse which may be raised to any potential desired. Beginning, first, with the call-boxes, which are distributed about the town on a series circuit, or upon a number of circuits, these instruments are entirely self-contained. In each is a spring which is wound up by the fire chief when he sends in the "fire-out" signal. Introducing a key into the box and turning it liberates a short train of powerful clock-wheels geared to the armature of a strong magneto in such a way that the latter is given a series of half turns corresponding to the number sent out by the box. The turning of the armature is accomplished by a lever and ratchet system operated by a cam driven by the main spring and cut into such shape as to send the predetermined signal from its particular box. At the receiving station is placed a polarized electro-mechanical gong, or relay, as may be desired, or the functions of the two may be combined, as is well shown in Fig. 3. This represents a circuit of fire-alarm boxes connected with an electro-mechanical gong, shown at C, which acts also as mechanical relay. It will be noticed that the levers G and H connect the striking hammer of this gong with the armatures of a number of magnetos, which may be connected either to such apparatus as is shown, or to any other form of repeating apparatus that may be desired. In Figs. 1 and 2 is shown a highly ingenious apparatus used to test the continuity of the circuit on which the boxes are placed, and which instantly indicates should the latter be open. A powerful magneto, shown at the top of the illustrations, has its armature coupled by means of the lever, Q, the connecting rod, P, and the rod, O, to the weight hung from the lever, U. On the back of the machine, as shown in Fig. 1, is a clock-work connected with an escapement, which continually turns the wheel, M, upon the edge of which are rollers engaging with the rod, O, and through it gradually forcing the armature of the magneto to the position indicated in Fig. 2. This wheel revolves so that one of its rollers passes the end of the rod, O, about every two minutes. As soon as the roller passes, the weight tends suddenly to jerk the armature back to the position indicated by dotted lines, but since the apparatus is connected through the closed circuit of boxes the resistance offered to the flow of current in the armature circuit is so great that the apparatus settles quietly back without producing energy sufficient to ring the bells in circuit.

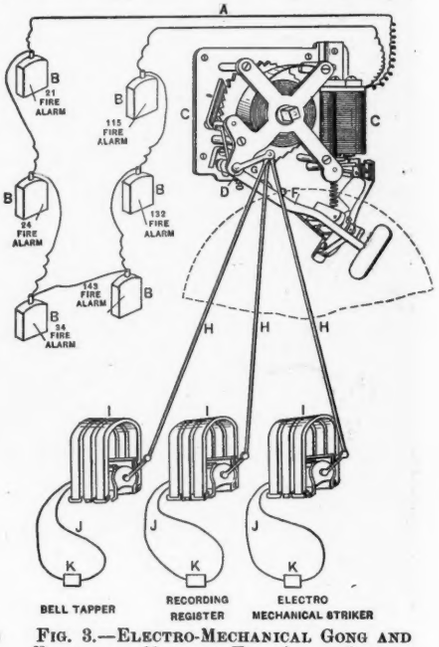


FIG. 3.—ELECTRO-MECHANICAL GONG AND RELAY FOR MAGNETO FIRE-ALARM SYSTEM.

Should, however, the circuit be open, there will be no resistance to the movement of the armature and the weight will descend suddenly, striking the upper end of the vertical rod, V, which is attached to a bell, as shown. This gives its warning signal for open line, and continues to give it every two minutes, until the line is repaired. Should a number of circuits of boxes enter the same station a simple commutating device will readily connect them in turn to this testing apparatus, which may then be speeded up, if desired, so that each line is tested at regular and short intervals.

It will be seen, from the foregoing description, that this system is entirely independent of batteries, and that, on account of the large energy that may be im-

parted to the magnetos, currents of great strength can be used and long circuits worked, or, by the aid of the repeating mechanism shown in Fig. 3, even large tower bells may be struck. As will be noticed, there is not an open contact anywhere in the system, nor is there anywhere a contact of the operative variety to keep clean, or rather to get dirty and out of order at the moment when it is most needed. The system is of such great simplicity and extraordinary ingenuity as to recommend itself highly to those practically concerned in fire-alarm apparatus.

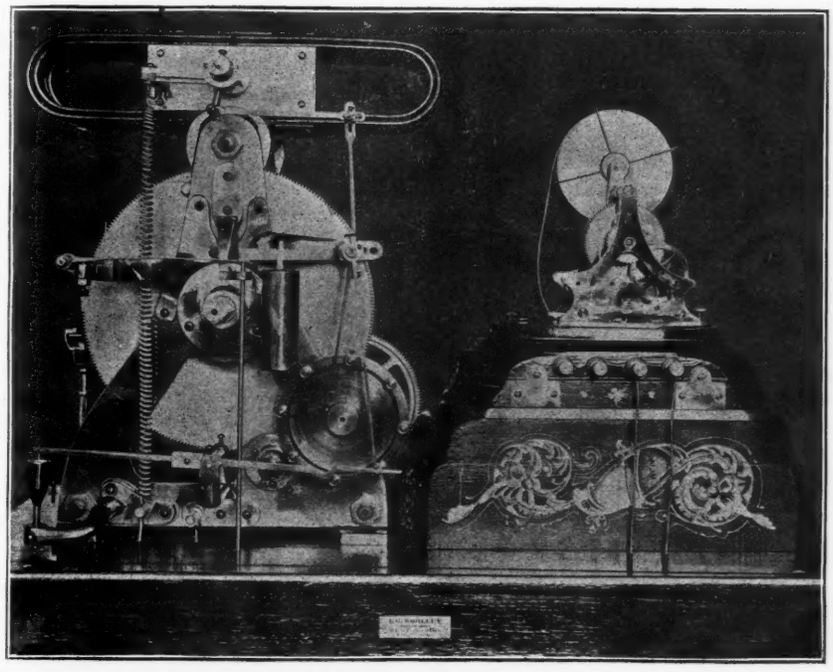


FIG. 4.—LINE TESTER OF MAGNETO FIRE-ALARM SYSTEM.

Electric Railway Progress in London.

[*From Electricity, London.*]

The American electrical engineer who wrote to the ELECTRICAL REVIEW, New York, that the great success of the Central London line is just waking things up said no more than the truth. There are rumors on every side of pending electrical projects of a similar kind, and it seems to me clear that the Hampstead and Charing Cross line, of which I spoke the other day, is really in a fair way to be started. Among other merits claimed for the electric tube is that of the restoration of appetite. One gentleman asserts that he had suffered from loss of appetite for 18 months, but reached home ravenous after his first journey in the Tube, and has maintained his appetite ever since by journeying continually therein. So true it is that none of the results of commercial enterprise can ever be fully foreseen.

Wall Street and the Electrical Stock Market.

Last week's market has been plainly reactionary and this in Wall street is considered a happy event as it bars out holders of weak speculative accounts which invest the market with danger. The fluctuations have been especially nervous in some of the industrials. One surprising feature was that stocks of the same kind would go in entirely opposite directions. This is due apparently to the fact that after election every stock, regardless of its intrinsic value, went up; now the better ones go up and the others follow their own course. Big selling was the reason for the downward movement of the market, and this movement permitted the prudent investors who did not care to carry stocks over the election, to use the money they kept ready for their first chance. Another interesting feature of the market is the collapse of several bucket shops that have lured victims to their games by various devices. The Boston market was much duller Saturday than during the week.

On the New York Stock Exchange, General Electric closed at 167½ bid and 168½ asked, indicating a gain of 8 points for the week, and 27 points higher than two weeks ago, showing also very firm prices. Metropolitan Street Railway, of New York, closed at 173 bid and 173½ asked, showing a gain of 3 points. Brooklyn Rapid Transit closed at 74¼ bid and 74⅜ asked, indicating a gain of 3⅛ points. The company reports gross earnings for October of $991,454, an increase of $9,834 as compared with the same month of last year, and net $351,472, an increase of $65,306. For the four months ending October 31 the gross earnings were $4,217,912, an increase of $211,075 as compared with the corresponding period of last year, and net $1,616,388, an increase of $432,099. Third Avenue Railroad closed at 112 bid and 112½ asked, indicating no change in the bid price and a gain of ½ point in the asked price. Manhattan Railway, of New York, closed at 110¾ bid and 111 asked, showing a loss of 1⅛ points for the week. Consolidated Equipment closed strong at 12½ bid and 12¾ asked, a gain of 3 points for the week.

On the Boston exchange, American Telephone and Telegraph closed at 159 bid and 160 asked, showing a gain of 5 points for the week. Erie Telephone closed at 107 bid and 108 asked, indicating a gain of 2 points.

On the Philadelphia exchange, Electric Storage Battery was not quoted. Electric Company of America closed at 10¼ bid and 10½ asked, showing a loss of ½ point for the week. Union Traction closed at 35 bid and 35½ asked, indicating a loss of 1⅛ points for the week.

On the curb, or outside market, in New York, Electric Vehicle closed at 19 bid and 20¼ asked, showing a loss of 1 point. Electric Boat closed at 18 bid and 20 asked, showing a gain of 1 point for the week.

Wall street, November 24.

An Echo of the Sound Money Parade.

"In the sound money parade which took place on a recent Saturday, in New York, the Electrical Industries Association was largely represented," says the London, England, *Electrical Engineer*. "It is difficult in this country, where we do not have to elect the supreme head of the state every four years, to understand the excitement which such an election causes. Thus, while we can quite see that large interests are at stake, it is not clear how these interests are served by some 100,000 men marching in procession through the heavy rain in order to show on which side their sympathies are. We gather from a short notice of this parade in one of our electrical contemporaries that from 3,000 to 5,000 electrical marchers were expected to be present."

Motor Switch Suit.

A suit has been entered in the United States Court at Trenton, N. J., by the Thomson-Houston Electric Company, of Schenectady, N. Y., and Edward H. Lewis, of Philadelphia, against the Sprague Electric Company, of New York city, its object being to restrain the defendant from using an electric motor switch for which the plaintiff claims to have a patent.

Electric Railways

Contracts have been let and construction work begun on the large stone power-house of the Union Street Railway Company, of New Bedford, Mass. The building will measure 150 by 100 feet and the cost is estimated at $100,000.

The new line which is expected to run from Frankford to the falls of the Schuylkill River is in process of construction, and is expected to be complete before the Summer season opens. It will begin in Frankford at Arrot street, and be about 10 miles in length.

An ordinance has been passed by the township committee of Princeton, N. J., which will permit the Trenton Street Railway Company to continue its tracks to Alexander street, this being the first step toward building the road through to the University grounds.

Michigan and Indiana capitalists have recently incorporated a company for the purpose of connecting Toledo, Ohio, with Chicago, Ill., by an electric street railway, which will be known as the Chicago & Toledo Railway Company. The line will extend through Newton, Jasper, Pulaski, Fulton, Kosciusko, Whitney and Noble counties.

Colorado capital is said to be interested in projecting the Sante Fe electric railway, of Sante Fe, N. M., to the Cochite mines, and a report from Sante Fe states that authentic information received in that city says the work on the proposed line from Durango to Albuquerque will commence early next year. The same capital is behind both roads.

A letter to a Maine newspaper by the president of the Bangor, Orono & Old-town Railway Company, states that the company will build a power-house as soon as a favorable location can be obtained. The road has been at a great disadvantage in the matter for some time past, which has resulted in considerable loss to the road and inconvenience to its patrons.

The franchise of the Lancaster Traction Company, of Lancaster, Ohio, has been rescinded by Judge Dwyer, of Dayton, on the ground that construction was not begun within the time limit provided for in the charter, and application for another electric railway line has been made to the county commissioners. The new company will be known as the Columbus, Winchester & Lancaster Traction Company, and will be ready to begin work in the Spring if the franchise is granted, as it is expected to be by those who are promoting the line.

A movement is said to be on foot in Bellefontaine, Ohio, to convert the abandoned steam line of the Detroit & Lima Northern Railway to an electric system. The road was recently sold at receiver's sale for $200,000, and the purchasers are said to have determined to institute an electric system, as the latter is considered to be more in the nature of what the people desire.

The Brooklyn Rapid Transit Company, Brooklyn, N. Y., has accepted the proposition of Bridge Commissioner Shea for running elevated trains over the Brooklyn Bridge, the trains to be operated by the regular bridge trainmen, at first only during slack hours on six minutes' headway, but afterwards at sufficiently small headway to meet the demands of the heavy traffic during rush hours.

A general reduction of fares on the system of the Tacoma, Wash., Railway and Power Company, between Tacoma and Puyallup, was instituted on November 1. Under the new régime commutation tickets are abolished, and only round trip tickets at a flat fare will be issued. The reduction in general is about five cents for the short distances, and 10 cents between Puyallup and Tacoma.

A branch line will be added to the system of the Schuylkill Traction Company, thus connecting Ashland with Fountain Springs, Pa., by trolley. The route will include a bridge, which is expected to span the Philadelphia & Reading tracks and the public highways at the southern end of Fountain Springs, thus placing the line on such an easy grade that access to the State Hospital may be easily obtained.

An electric line seems now an assured fact from Grand Forks, B. C., to Republic, across the Colville reservation. This statement is credited to W. C. Morris, of Republic, who is said to have stated that he has been assured a permit by the United States Government to cross the reservation, and it is expected that when the permission is granted, surveyors will be immediately put to work and the road built within the year.

A new electric link in New York's street car system has been instituted by the substitution of trolleys for the Forty-second street cross-town horse cars. These antiquated conveyances have been removed and in their place the most modern underground-trolley cars have been substituted, thus furnishing electric traction all the way across town and up the Boulevard line to the Fort Lee Ferry. This enables passengers to ride from Fort George to the City Hall for one fare.

Approval has been granted by the Massachusetts commissioners for the consolidation of the Lowell & Suburban Street Railway with the Nashua road, the former being the purchaser. The limitations on dividends on the Lowell & Suburban Street Railway have been removed, the impairment of its capital having been made good and the purchase of the Lowell & Suburban Railway by the Lowell, Lawrence & Haverhill road has been consummated.

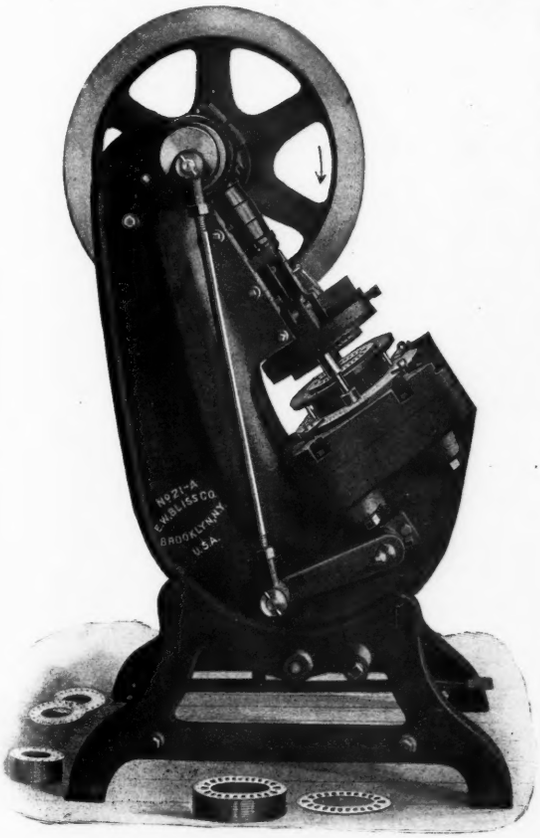
The management of the Erie railroad, whose Watchung branch (New York & Greenwood Lake Railway) running from Forest Hill to West Orange, N. J., is said to be contemplating a change of motive power from steam to electricity. The trolley line of the South Orange & Maplewood Traction Company is a continuation of the Watchung road, and the fact that the latter's tracks have been lengthened seems to point to a traffic arrangement between the two lines, if not to the absorption of the South Orange company by the Erie.

A consolidation of Penn Yan, N. Y., street railway interests is now being completed by Philadelphia, Pa., capitalists, who intend to issue $1,000,000 in first mortgage gold bonds to cover extensions and improvements to the five electric systems which will be consolidated. The lines which will be brought together under one management will be the People's Electric Street Railway Company, of Rochester, N. Y., Beaver Valley Traction Company, College & Grand View Electric Street Railway Company, Beaver & Vauport Street Railway Company, and the Rochester & Monarch Street Railway Company.

A lively controversy between the two street car companies of Knoxville, Tenn., is said to have assumed an interesting appearance, both lines expecting counsel to take action. The Electric Railway Company is said to have a contract with the city. Its officials are reported to have held that their franchise prevents the city from giving the right to the Rapid Transit Company to lay rails on streets occupied by itself. Both questions will be acted on at the coming meeting of the common council, and it is expected that some definite decision will be reached, each company's officials believing confidently that the decision will be unfavorable to the other.

An Improved Armature Disk-Cutting Press.

The accompanying illustration represents an ingenious and, at the same time, exceedingly simple improvement in armature disk-cutting presses recently produced by the E. W. Bliss Company, of Brooklyn, N. Y. The press is designed for punching small armature disks, and it is stated by the manufacturers that, on account of its inclined position which allows the blank punched and lifted out of the die by its "positive knock-outs" to slide off by gravity, the machine is enabled to do much more work in a day than other types of punches. This machine is made in a size suitable for punching disks up to 14 inches diameter where the disks are plain, but where they are notched complete at one stroke it works best up to sizes of six or seven inches, according to the style and number of the holes or notches. For punching notches in disks of a larger diameter a notching press is used. It is claimed by the makers that from 6,000 to 10,000 complete disks per day may be punched on this machine in its inclined position. The machine may easily be set up in a vertical position when, by displacing the "knock-out" arrangement and providing a bolster plate with suitable openings, blanks up to 14 inches in diameter may be cut out and dropped through the die.



ARMATURE DISK-CUTTING PRESS.

Erie Telephone Offices to Move to New York.

The Erie Telegraph and Telephone Company will abandon their Lowell, Mass., offices in the Glidden building on or about December 1, and will locate their entire clerical force in New York and Boston. In New York the company will occupy the 18th floor in the American Surety Company's building at 100 Broadway and in Boston the fourth floor in the building at 15 Congress street.

The departments transferred to New York will be those of President Glidden, Vice-President Pettengill, Secretary Perham, General Auditor Thorpe and Advertising Manager Greenslitt; to Boston, Vice-President Adams and Treasurer Grant. A private telegraph line will connect the New York and Boston offices.

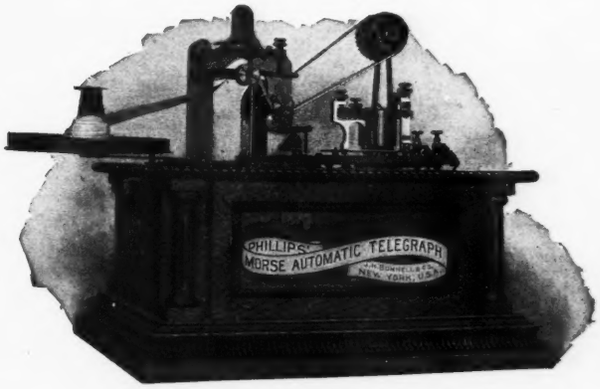
President Glidden expects to divide his time between the New York and Boston offices and expects to visit Lowell frequently.

Thief Steals Electric Light Poles.

A report from Mt. Vernon, N. Y., states that the police of that town are looking for the man who recently sold 75 poles of from 35 to 50 feet each in length for $400 to a lighting company of that town, the poles having been stolen from the Pelham Bay Electric Light Company. This latter company, which lights the upper section of the Borough of Bronx, had distributed the poles during the day through Pelham Manor, intending to set them up in the morning, but when the workmen arrived the poles were gone and the police say that a man who lives a few miles distant got seven teams, gathered up all the poles during the night, and delivered them the next day to his purchaser. The Pelham Bay company estimates its loss at about $700.

An Automatic Telegraph Instrument.

The instrument shown in the accompanying illustration is designed to facilitate the learning of telegraphy and for giving an operator opportunity for practice in receiving by sound. It is known as the Phillips-Morse Automatic Telegraph, and consists of an embossing machine by which Morse characters are embossed on a strip of paper which is then fed through the apparatus shown at the left of the illustration and automatically reproduces itself as the familiar clicks on the sounder shown at the right. The speed may be adjusted at from 10 to 100 words per minute as desired, and the instrument is thus enabled to give all of the facilities of actual line practice in railroad, commercial, stock-quotation and press-work. It is manufactured by J. H. Bunnell & Company, New York.



AN AUTOMATIC TELEGRAPH INSTRUMENT.

New Cable Between Netherlands and England.

United States Consul Listoe, of Rotterdam, sends the following: The laying of a third telegraph cable between the Netherlands and England, from Zandvoort to Lowestoft, was commenced on the 8th of October last. The cable comprises four wires, which will extend all the way from London to Rotterdam and Amsterdam. Telegraphing over these wires will be done by means of the Hughes apparatus, and at busy times with duplex Hughes apparatus. The cost of construction of the cable will be borne by both countries. The cable will greatly accelerate the telegraph traffic between the Netherlands and England. The new connection will also expedite the receipt of American cablegrams via London, as one of the wires will be immediately connected with the cables of the Anglo-American Telegraph Company at London, thus making cabling to the United States possible without the intervention of the London office.

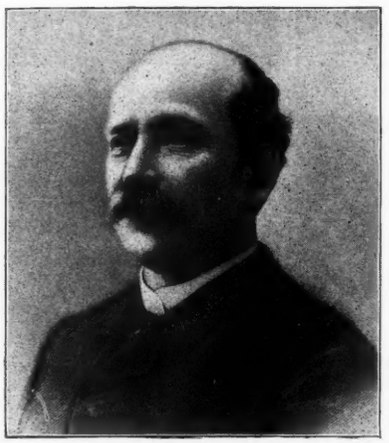
Death of W. H. Lawrence.

W. H. Lawrence, president of the National Carbon Company, of Cleveland, Ohio, died at his home at Dover Bay, Ohio, on November 23, of heart failure. Last July Mr. Lawrence while playing tennis broke his arm. The bones failed to unite and several weeks ago his state of health was such that a consultation of physicians was called and it was decided to amputate the arm. The operation was performed at Mr. Lawrence's home but he did not survive the shock. He leaves seven children, all daughters. Mr. Lawrence was a pioneer manufacturer of electric light carbons, and as such has been connected with the electrical industry for many years. He was a gentleman of considerable means and high business standing. When the National Carbon Company was formed in January, 1899, he was chosen to become its head and as such he had carried on the business ever since.

Washington H. Lawrence was born at Olmsted, Cuyahoga County, Ohio, on January 17, 1840. He was a descendant of John Lawrence, one of the early settlers of the Massachusetts Bay colony. Mr. Lawrence's parents died when he was 12 years of age, and he began life as a clerk in Berea, Ohio. He attended the common schools at Olmsted and afterward pursued a course of study at Baldwin University. At the age of 19 years Mr. Lawrence and Milton Baldwin, a son of the Hon. John Baldwin, were placed in charge of the latter's large milling and real estate properties in Kansas. Soon after Milton Baldwin died, and the entire burden of the care of the property fell upon Mr. Lawrence. In 1859 Mr. Lawrence concluded his connection with Mr. Baldwin and engaged in business with his brother at Hannibal, Mo. While so engaged he was compelled to travel through western Missouri and eastern Kansas and saw much of the border warfare that followed the struggle over Kansas, as well as having many experiences in the early days of the rebellion. In 1864 he removed to Cleveland, Ohio, where he engaged in the manufacture of sewing machines. He was also interested in the manufacture of bolts at Elyria, Ohio, in a plant which now forms part of the Cleveland Screw and Tap Company's shops.

Mr. Lawrence became associated with Mr. Charles F. Brush at the inception of the Brush Electric Company, furnishing a large portion of the original investment. With characteristic pluck and courage he retained his connection with the firm through many trying times and remained with it until the Brush company had a capital of $3,000,000, and Mr. Lawrence was the general manager of the then largest electrical establishment in the world. In 1882 Mr. Lawrence decided to take a much needed rest and severed his connection with the Brush company. He invested largely in Cleveland real estate for several years and devoted his leisure to its management.

In 1886 he turned his attention to the manufacture of electric light carbons and became associated with Mr. Masters in what is now the Willson avenue factory of the National Carbon Company. Later, on account of failing health, Mr. Masters retired and Mr. Lawrence with his associates, M. T. Herrick, James Parmlee, Webb C. Hayes and others, became the owners of the entire business under the name of the National Carbon Company. Mr. Lawrence was also at one time president and general manager of the Sperry Electric Railway Company.



W. H. LAWRENCE.

OBITUARY.

Dexter A. Smith, vice-president of the Empire State Telephone and Telegraph Company since its organization in 1880, died suddenly at his home in Auburn, N. Y., on Wednesday, November 21, in the fifty-eighth year of his age. Mr. Smith, who was one of the leading hardware dealers in central New York, became interested in telephone matters at an early day, and is well known to all the old timers. He was the first vice-president of the Hudson River Telephone Company and was one of the promoters of that company and of the Central New York Telephone and Telegraph Company.

PERSONAL.

Mr. H. Durant Cheever, of the Okonite Company, and his wife sailed recently for London. It is Mr. Cheever's intention to remain several weeks in London looking after the expanding foreign business of his company.

Mr. Horatio A. Foster, the well-known electrical and mechanical engineer, has removed from Buffalo, N. Y., to Philadelphia, where he has established himself as a consulting engineer at 310 Chestnut street. While engaging in general practice Mr. Foster will, as during the past 10 years, make a specialty of reports upon street railway, electric lighting and power transmission properties for investors.

It is reported that Mr. Lyman McCarty, of New York city, will, on January 1, become general passenger agent of the Baltimore & Ohio Railroad, filling the vacancy caused by the death of J. M. Shryver. Mr. McCarty has been connected with the Baltimore & Ohio Railroad for 28 years, and is popularly known to a large number of the electrical fraternity, with many of whom he has had personal dealings.

Dr. Daniel C. Gilman has announced his determination to resign from the presidency of Johns Hopkins University, and while his advanced age is given out by Dr. Gilman as the reason for his retirement, it is stated that the real reason is the financial condition of the university. Several candidates for the presidency have been mentioned, prominent among whom are Dr. Woodrow Wilson, of Princeton University; Professor Ira Remsen, Sc. D.; Dr. Herbert B. Adams and Dr. Albert Shaw, of the *Review of Reviews*. Dr. Gilman has been president of the institution for 25 years and his resignation will take effect at the end of the present university year.

Mr. Asa M. Mattice has been appointed chief engineer of the Westinghouse Electric and Manufacturing Company, and will enter upon his duties in December. Mr. Mattice was for 10 years up to a year ago principal assistant to Mr. E. D. Levitt, of Cambridgeport, Mass., and has been actively connected with the design of all the large machinery coming from Mr. Levitt's office during that time. During the past year he has been remodeling the Cocheco Cotton Mills at Dover, N. H. Mr. Mattice is an engineer graduate of the Naval Academy of the class of '74, of which class Mr. B. H. Warren, vice-president of the Westinghouse Electric and Manufacturing Company, is also a member. He was assistant to Admiral Melville at the beginning of the new navy, and had an important part in the design of the machinery of the Maine, San Francisco and others of the important early ships. The Westinghouse company is to be congratulated on the additional strength which he will give to their already strong engineering staff.

QUICK ELECTRICAL WORK IN CORNING.

BY FRANK P. FOSTER.

The history of the present installation of electric lights in the city of Corning, N. Y., is interesting on account of the remarkable speed with which the plant was put up in spite of numerous difficulties.

For a long time the city council had advertised for bids for street lighting as they were dissatisfied with the prices they had been paying, but until the conditions with which they surrounded the bids were modified, nobody seemed willing to bid or to accept the provisions that were imposed by the municipal authorities. On August 6 a contract was made with Mr. Robert E. Drake. This contract covered the lighting of the streets and public places of the town with not less than 76 arc lamps, each of 2,000 candle-power, the consideration being a payment of $80 per lamp per year and the term of the contract 10 years from date. The same day that the contract was authorized by the council it was executed by the Mayor and the contractor at once furnished a bond of $5,000 to make certain his having the plant running on November 1.

On September 12 the Corning Light and Power Company was incorporated and the franchises granted to Mr. Drake and the contract with him were taken over by that corporation. On September 27 the powerhouse of the Corning & Painted Post Street Railway Company was leased by the new concern for a term of 10 years, and orders were given for an addition to the building to contain the necessary electric light machinery. Despite the fact that the poles had to be shipped from North and South Carolina—southern white cedar poles were used—and also that it was difficult to secure wire in time to keep everything moving, the lamps were burning at the time called for in the bond, or two months and twenty-four days after the authorization of the project by the city council. Much of the credit of this rapid piece of work is due to the superintendent of construction, Mr. Stocker, who had charge of the work of installation.

A Hood Reflecting Shade.

The Kneeland Reflector Company, 222 Friend street, Boston, Mass., is manufacturing a hood shade for desk use which the company claims concentrates the light

A Hood Reflector Shade

and increases the power of the incandescent lamp on which it is used. In the type illustrated herewith the shade is entirely coated with green enamel with the exception of the lower part which is made of ground glass through which the light is thrown. The shade is manufactured in five sizes—5, 7, 8, 9, 12 and 15 inches in diameter and can be furnished in silver, green, bronze or green enamel, to suit the wishes of the customer.

Igniting Apparatus for Gas and Vapor Engines.

The ignition of the inflammable vapors in the cylinder of a gas engine by electric sparks has proven one of the most interesting and at the same time difficult problems that electrical engineers have been called upon to handle. The accompanying illustrations represent some igniting mechanisms that have been used for a long time and which are believed by their maker, the Dayton Electrical Manufacturing Company, of Dayton, Ohio, to be highly perfected for their special use.

Fig. 1 shows an igniting dynamo, the door of the casing being open to show the interior of the apparatus. This machine weighs 20 pounds and will operate either touch or jump spark igniters as desired. Fig. 2 shows an igniting dynamo of the same type which is, however, mounted on a base containing a spark-coil which is entirely saturated with paraffine, thus making it moisture and water-proof. This machine is also fitted with a regulating governor pulley which maintains its speed constant.

For starting engines a sealed storage battery is furnished, the machine being small and entirely self-contained and so arranged that there is no danger of poor connections or leaks from it. This machine is used in connection with the dynamo and is constantly charged from it so that it needs no attention whatever.

These machines are made under the patents of Mr. Vincent G. Apple, which cover the employment of a dynamo, a battery and a spark-coil all in circuit with the contact points of an explosive engine.

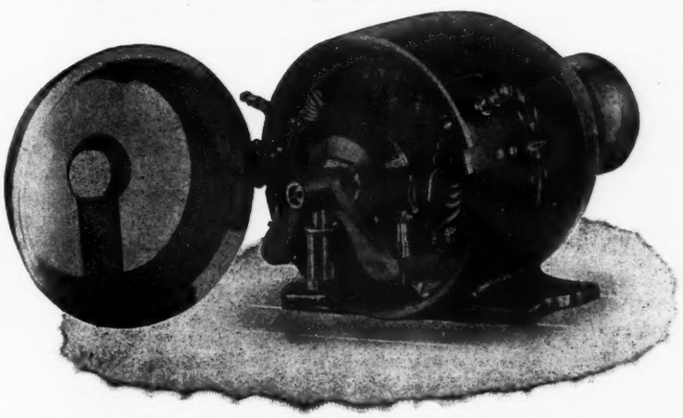


Fig. 1.—A Gas Engine Igniting Dynamo.

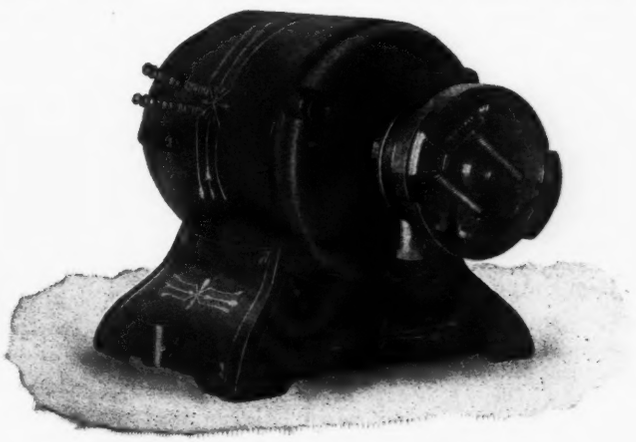


Fig. 2.—Igniting Dynamo with Spark Coil.

Address Wanted.

An interesting communication, requiring an answer, has been received from Mr. J. C. Callery, at Kings Mills, but unfortunately the state was omitted from the address and we are unable to find the post office. If this gentleman will send us his full address we shall be pleased to reply.

Railroad Commissioner Kayler, of Ohio, has ordered the Dayton & Xenia Traction Company to place safety devices at a number of dangerous grade crossings. The company has agreed to use a derailing device, electric locking device and safety gates. The principal points at which these equipments are to be put in are Xenia, Greenville and Harris Station.

The work on the Canton-Alliance, Ohio, Electric Railway is progressing nicely and over two miles of the roadbed west of Alliance is ready for the ties. The power house and car barns will likely be located at Louisville.

Corporation News

SARATOGA, N. Y.—The Hudson Gas Motor and Vehicle Company has been incorporated by New York capitalists for $100,000.

LAFAYETTE, IND.—A charter has been granted to the Sterling Electric Company, of Lafayette, which has been capitalized at $100,000.

CHICAGO, ILL.—Local capitalists have incorporated the Auto Appliance Company, with a capital stock of $50,000, to manufacture automobile accessories.

ALBANY, N. Y.—With a capital stock of $100,000 the Hudson Motor Vehicle Company, of Saratoga, N. Y., has been incorporated by local capitalists.

NEWARK, N. J.—At the office of the county clerk, in this city, articles of incorporation were granted to the American Light, Power and Transportation Company, capitalized at $1,000,000.

CHICAGO, ILL.—Local capitalists have incorporated the Continental Telephone Construction Company, of Chicago, their object being to operate and construct telephone systems within the state.

INDIANAPOLIS, IND.—With a directorate of three, the Thorntown Electric Light Company has been incorporated, its capital stock amounting to $15,000, one-half of which has already been subscribed.

DOVER, N. H.—Application for a charter has been filed by the Portsmouth, Great Bay & Dover Street Railway Company, which will be capitalized at $75,000 capital, being subscribed by New Hampshire interests.

COLUMBUS, OHIO—Local capital has recently incorporated the Cauldwell Independent Telephone Company with a capital of $5,000. It is expected by the promoters that active operations will be begun in the near future.

EVERETT, WASH.—The Monte Cristo Railway Company, of Everett, has been recently incorporated by three capitalists of that place to operate railways, telegraph lines, etc. The capital stock of the new corporation amounts to $1,200,000.

BIRMINGHAM, ALA.—The Boykin-Bullock-McCall & McDonnell Electric Company has been granted a charter with a capital of $40,000, subscribed by local interests. The company will manufacture and deal in general electrical supplies.

WHEELING, W. VA.—New York capital has recently incorporated another automobile manufacturing company for $250,000. The new corporation will be known as the Steam Motor Company of New York City, with its principal offices there.

NEW YORK CITY—Contracts have been let by the board of public improvements in New York city for lighting during the ensuing year, as follows: Manhattan, $960,000; Bronx, $350,000; Brooklyn, $950,000; Queens, $360,000; Richmond, $130,000.

BOSTON, MASS.—The Electric Safety Traction Company, of this city, has recently been incorporated to build and equip electric railways. The capital stock will amount to $5,000,000, and be subscribed principally by Massachusetts interests.

HALF MOON, N. Y.—Capitalists of Utica, N. Y., and Bridgeport, Ct., have recently chartered the Dunsbach Ferry Electric Company, of Half Moon. The object of the company will be the supplying of electricity for light, heat and power in Waterviiet and Half Moon.

CROSSVILLE, TENN.—A company whose intention is to light churches and the public streets has been incorporated recently with a capital of $2,000 and will be known as the Crossville Electric Light and Power Company. Generating apparatus has already been purchased and operations will soon be begun.

DALLAS, TEX.—Concurring with the application of the American Land and Trust Company, of Boston, Mass., a receiver has been appointed for the Dallas Electric Company, from whom a $20,000 bond has been required. It is stated that the cause of the receivership is the defaulted payment of interest on $300,000 worth of the Dallas company's bonds, which were held by the trust company.

ALLENTOWN, PA.—Application will be made to the state authorities on December 3 for incorporation articles for the Siegfried Power Company, according to a local paper. The corporation will have a capital stock of $300,000, which will be subscribed by New York financiers, whose purpose is to erect a plant at Siegfried, operated by water power for generating 3,500 horse-power for electric power and lighting purposes.

DENVER, COLO. — Hon. Henry V. Johnson, Denver's Mayor, and other capitalists of that city have recently incorporated the Automatic Railway and Switch Company, with a capital stock of $600,000, to manufacture street railway switches. The switch consists of a movable tip attached to a switch tongue, being operated by a rod which the motorman depresses with his foot. It is stated that the apparatus is very simple and that a factory will soon be established in Denver or the vicinity for its manufacture.

DOVER, DEL.—Among the list of corporations recently chartered in Dover, Del., are the following electrical companies: Bishop Electrical Company, of Wilmington, chartered for $50,000. Chicago Electric Motor Company, Wilmington, capital stock, $200,000. International Rapid Transit Company, of Dover, capital, $1,100,000. Jenkins Automobile Company, Dover, $100,000. Union Automobile Transportation Company, of Dover, $500,000. Canadian Searchmont Motor Company, of Wilmington, capital $50,000.

CHESTER, PA.—Under the name of the Philadelphia & Chester Railway Company, the Philadelphia & Baltimore Railway Company and the Prospect Street Railway Company have been consolidated and contracts have been let to Philadelphia contractors for building the line, the contracts including draw bridges over two streams, together with a large amount of modern car and electric machinery. It is expected that the new line will make 20-minute runs from Chester to the Philadelphia line and reduce the time from Chester to Philadelphia itself to about an hour.

PENN YAN, N. Y.—Papers were filed on November 5 in the office of the county clerk of Penn Yan, recording the formal transfer of the Penn Yan Electric Light and Power Company, the first deed being given by Guy D. Hills, who some time ago bid in the plant at a receiver's sale for $1. Though the sale price is small there are $362 worth of revenue stamps on the document. The second deed given by the stockholders of the plant is considered merely formal. Among the other papers was the mortgage given by the electric light company, which will hereafter be known as the Yates Electric Light and Power Company, the mortgage being executed in favor of the City Trust Company, in New York, for $125,000.

NORFOLK, VA.—A disastrous fire temporarily crippled the street car service of Norfolk on the morning of November 11, destroying the power house, car barns and 51 cars belonging to the Norfolk Railway and Light Company, the loss reaching $250,000, which is said to be covered by insurance. Within a few hundred yards of the scene of the fire is the local depot of the Standard Oil Company, which had it taken fire would have wiped out the street railway entirely. Fortunately for the local company the oil was untouched by the flames and the few cars remaining to it were being run on the afternoon of the eleventh by power supplied from the electric light plant, which, being in the lower section of the city, escaped damage.

ALLENTOWN, PA.—Another purchase has been made by the Lehigh Valley Traction Company, which has recently bought out the lines of the Allentown & Slatington Trolley, which is 21 miles long, running through the most important part of Lehigh County. Previous acquisitions of the company included the Slate Belt trolley line, which runs through the slate district in Northampton County. Altogether the company's direct system will have a total length of about 53 miles, which is said to be the longest direct trolley road in the world. The total length of the traction company's entire system is about 110 miles, but improvements which are soon to be made in the former extension from Slatington to Mauchunk will add 12 miles more to the length of the road.

Views, News and Interviews

An iron safe in the office of a western shoe factory was the cause of an accident recently which cost two men their eyesight. The safe refused to open and the bookkeeper and engineer decided to burn out the combination by means of an electric arc and carbon. They finally succeeded in doing this, but a short time afterward both complained of pain and vertigo, which grew worse as the time passed and suddenly both went blind, their sight being entirely destroyed.

A new departure in the police department is the detailing of bicycle policemen for the inspection of automobiles, the idea being to have the officers stationed at ferries and on popular thoroughfares to look after steam and motor vehicles, and see that the driver, or whoever is in charge, possesses a license, and that the vehicle bears the tag on which is stamped its regular license number.

In a letter to President Low, of Columbia University, New York, Professor W. C. Von Roentgen, the discoverer of the Roentgen rays, acknowledges the Barnard Medal, conferred upon him last June, and says: "Through the bestowal of the medal by a scientific institution as illustrious as Columbia University, acting in conjunction with the American Academy of Sciences, my work upon the X-rays has received a recognition which, though in my estimation greater than it deserved, has nevertheless pleased me very much. It will be a spur to greater effort."

While the election returns were coming in on Tuesday night at the Orange Club, in East Orange, N. J., Mr. Thomas A. Edison, who was present, was asked by one of the other members if he could work the key himself. Replying that he could, Mr. Edison not only received the returns, but did the old trick of receiving one message and sending another at the same time, greatly to the delight and amusement of his fellow-clubmen.

While working in a manhole at Twenty-second street and Third avenue, New York, an electrician of the Third Avenue Railroad, by the name of Adam Munn, attempted to release part of the motor of a car which was blocking the entire line. While Munn was still in the manhole the fuse blew out, and he was badly scorched, becoming unconscious. After about 20 minutes he revived, and continued his work; but the next night he suffered great pain in his eyes, and, finally, on receiving medical advice, it was found that temporary paralysis of the eyelids had set in, and it is feared he may lose his sight as a result of the accident.

When Tyndall refused to join in an expedition because he needed to study certain practical applications of electricity for his approaching lectures, Huxley simply answered:

MY DEAR TYNDALL:

DAMN
the
l
e
c
t
u
r
e
s

T. H. H.

That's a practical application of electricity for you.—New York *Evening Post.*

Not long since an Irishman went into the salesroom of a London, England, automobile manufacturer and after much parleying decided to purchase a vehicle, asking, however, what the brake was for. The salesman replied that it was to be used on hills. Mike took his machine, learned to drive it pretty well, and one day determined to make a trip through hilly country. Coming to a steep grade he clapped on the brake and was toiling laboriously up when some friends hailed him, shouting to him to reverse the brake, but Mike, with Celtic geniality, replied gravely: "Whisht! man. Can't you understand—'tis to keep the machine from going back down the hill!"

A Boston humorist has it that the "Knights of the Road" who hail from the city of Browningesque are responsible for the word automobile. Meaning, as it does, self-moving, it is not difficult to account for the Bostonian's theory—even though the word is French.

A report from the medical faculty of the University of Heidelberg, Germany, comes to the Department of State through Consul Hughes, of Coburg, regarding the effect of incandescent light on the eyes. It has been stated at various times that the incandescent light was injurious, but the present verdict is that so far from being evil in its effects it is especially to be recommended from a hygienic point of view for lighting large halls or other places of entertainment, the electric light preceding the incandescent gas flame in point of salubrity.

The Glasgow, Scotland, Corporation will soon issue £1,250,000 in new bonds in addition to its present funds to cover the cost of the electric construction and equipment of its present and intended tramway lines, power station and railway stock, and as considerable American machinery has already been installed in Glasgow, it is presumed that the contracts will come to this country. The second shipment of cable for the road, valued at $14,000, has just been sent to Glasgow.

An express railway service is being projected in Belgium to run between Brussels and Antwerp. According to present rumors the starting point will be the Place de Palais, in Brussels, the line running underground as far as Schaerbiek from whence it will run to Antwerp parallel with the state railway tracks. The line will be 27 miles in length and according to present estimates and figures the run will be made in 28 minutes, the total cost of the road being $10,000,000.

Bids are invited by the Board of Public Works in Madrid, Spain, for the construction and operation of an electric railway to Aravoca and Pueblo de Alarcon. The Spanish posts and telegraph administration in the same city are also asking bids on tape paper for the telegraph service for a period of five years, beginning with 1901. Throughout the entire empire extensive improvements are contemplated in electric light and power plants, which will require considerable material, and the statement of local merchants, who are in a position to know if any one does, that American manufacturers can secure the lion's share of the business by making proper efforts is interesting. Engineering and contracting firms in this country can not be too strongly urged to push the matter to the limit. Already much of the electrical apparatus and many of the largest electrical enterprises in Spain are of American make and under American management, although considerable of the materials have been furnished by British engineering firms who secured contracts, bought the goods in the United States and re-exported them to Spain. The opportunity is at hand and the manufacturer who fails to realize the importance of making every effort to secure the business has only himself to blame. The very fact that American apparatus should be sold and installed in a foreign country by British enterprise is a comment of value on the slack methods of firms in the United States.

Industrial Notes

CONTRACTS for the seven new bridges on the lines of the Allegheny Valley Railroad have been let to the American Bridge Company.

THE CENTURY TELEPHONE CONSTRUCTION COMPANY, Cleveland, Ohio, has commenced the construction of a 400-instrument line at Salamanca, N. Y.

MATHIAS KLEIN & SON, Chicago, have received an honorable mention from the Paris Exposition for their exhibit in the department of telegraphy and telephony.

THE COUCH & SEELEY COMPANY, Boston, Mass., manufacturer of telephone apparatus, is now perfecting a new system of telephone apparatus for central-energy service.

J. H. BUNNELL & COMPANY, 20 Park place, New York city, is sending out printed matter illustrating and describing at some length the Phillips-Morse automatic telegraph.

THE L. B. ALLEN COMPANY, Chicago, Ill., is making an effort to place samples of its soldering paste, soldering stick and soldering salts in the hands of every electrician in the country.

THE DRIVER-HARRIS WIRE COMPANY, Newark, N. J., has recently issued some interesting literature relative to the character and quality of resistance wires, particularly as to their use in electrical work.

THE GEO. A. FULLER COMPANY has ordered from the Western Electric Company, Chicago, two 100-kilowatt and one 50-kilowatt type "L" machines, to be installed in the Willard Hotel, Washington, D. C.

THE ELECTRIC APPLIANCE COMPANY, Chicago, Ill., wishes to state in answer to numerous inquiries made that the Gutmann wattmeter is not made at present for direct current. The type it is selling is for alternating current only.

ROESSLER & HASSLACHER, 100 William street, New York, manufacturing and importing chemists, have given special attention to the perfection of the "Battery Brand" of sal-ammoniac and chloride of zinc for battery consumption.

MOLONEY ELECTRIC COMPANY, St. Louis, Mo., has recently prepared a new booklet, illustrating and describing the most improved types of Moloney transformers. These types are made in many sizes for any frequency and any voltage.

THE ROBBINS & MEYERS COMPANY, Springfield, Ohio, is having great success in the introduction of the new protected type of dynamos. These machines are made for direct-current service and are of the multipolar character. This company's New York office, 136 Liberty street, is under the management of Mr. W. B. Van de Water.

THE CUTLER-HAMMER MANUFACTURING COMPANY, Milwaukee, Wis., has issued a new catalogue of its iron-clad type of field rheostats. This company is now operating, in addition to the Milwaukee plant, a factory at Westfield, N. J., and it is also maintaining an office at 136 Liberty street, New York, for the transaction of eastern business.

THE GUARANTEE ELECTRIC COMPANY, 133-139 South Clinton street, Chicago, Ill., operates large electrical repair shops for the care of all electrical apparatus. This company also carries on hand constantly a large amount of electrical machinery of many types, and practically all wants for electrical equipments may be appeased through this house.

THE FORT WAYNE ELECTRIC WORKS, Fort Wayne, Ind., has issued a circular descriptive of pocket meter-sealing tools and meter-reading books. In appearance the sealing tools strongly resemble a pair of compound wire cutters, except that the cutting edges are absent, heavy seals being substituted. A set screw regulates the sealing device.

G. B. PRATT, Gowanda, N. Y., eastern representative of the Eureka Electric Company, Incorporated, of Chicago, Ill., is sending out handsome lithographed calendars in gray and brown for the new year. Mr. Pratt handles the telephone instruments and supplies manufactured by the Eureka company. He will send his calendars to any one interested in telephone apparatus and accessories.

THE BARSCHALL IMPREGNATING COMPANY, 31 Nassau street, New York, which controls the Hasselmann impregnating process for the preservation of wood, is receiving the attention of many prominent engineers who appreciate the vital feature of wood preservation in construction work, particularly as it applies to railroad ties, telegraph and telephone poles, cross-arms and all exposed woodwork. The company is operating a well-equipped factory at Bayonne, N. J., which was recently described in these columns.

THE WARREN ELECTRIC MANUFACTURING COMPANY, Sandusky, Ohio, in its bulletin No. 14, relative to the Warren alternator, has incorporated a particularly concise and interesting description of the advantages and merits of alternating machines, the present status of the construction of alternating dynamos and a careful analysis of the operation and maintenance of these machines; also a few words relative to its generator switchboards. The bulletin is especially well illustrated and should be of interest to electrical engineers.

THE COLUMBIA INCANDESCENT LAMP COMPANY, St. Louis, Mo., is making a special effort at this season of the year, when the demand for incandescent lamps is at its height, to carry in stock at its branch offices a complete supply of the various types of Columbia lamps, so that patrons may receive quick and prompt deliveries. The branch offices of this company are Havemeyer Building, New York; Paul Seiler Electrical Works, San Francisco; Central Electric Company, Chicago; Equitable Building, Boston, and 17 South Fourth street, Minneapolis, Minn.

THE SPEER CARBON COMPANY, St. Marys, Pa., manufacturer of self-lubricating motor and generator carbon brushes, after being in operation one year, finds its plant entirely too small to handle the large number of orders received every day, and is now enlarging its plant to double its former capacity and will soon be in a position to take care of all orders for carbon brushes and electric light carbons for open arc lamps. Its goods are said to be giving better satisfaction than ever, and the company reports having closed recently some very large contracts for its product.

THE WAGNER ELECTRIC MANUFACTURING COMPANY, of St. Louis, Mo., has issued a handsome general catalogue containing descriptive matter of its transformers, single-phase alternating-current motors, wattmeters, ammeters and voltmeters of the illuminated-dial switchboard type, automobile charging outfits, high-tension fuse cutouts, ventilating fans and street railway switchboards. The catalogue is handsomely gotten up on heavy calendered paper, the illustrations being well executed half-tones and line cuts, and the binding of the book a green adjustable cover stamped in gold.

MR. E. WOODRUFF, president, and Mr. Thomas Elliott, chief engineer, of the Atlanta Railway and Power Company, of Atlanta, Ga., have just awarded the Siegrist Lubricator Company, of St. Louis, Mo., a contract to equip all machinery in their new 12,000-horse-power plant with the Siegrist automatic oiling system, and, though a gravity system of the latest design was ordered with the machinery, they substituted the Siegrist system when they investigated and found what a large saving it would make them, besides the many other advantages which are not obtainable by gravity or other devices.

WILLIAM ROCHE, 42 Vesey street, New York, inventor and manufacturer of the "New Standard" dry battery, speaks of having received from a Western telephone company one order for half a million cells. These cells are unquestionably growing into more universal use and the reports which hundreds of practical electricians are making is splendid evidence of the material accomplishments which Mr. Roche has attained in constructing these cells. This firm is also placing before the electrical trade a new combination of dry cells known as the "Autogas" for portable ignition work, automobiles, launches and where compactness is requisite.

THE WESTERN TELEPHONE CONSTRUCTION COMPANY, Chicago, Ill., has secured the contract to furnish the Binghamton, N. Y., telephone exchange with a 2,400-capacity, 1,200-equipped, complete central energy equipment. The "Western" has recently furnished the Chicago & Alton Railroad with telephone equipment for its main line between Chicago and Bloomington, connecting the general offices of the company, in Chicago, and the Union Station with Bloomington and other points along the line. It has also furnished the Union Elevated Loop, Chicago, with telephone equipment, connecting the main offices, in the Fisher Building, with all its stations upon the Loop.

THE ALDEN ELECTRIC COMPANY, INCORPORATED, of Chicago, Ill. (formerly Alden & Company), was incorporated in September last and is now established in its new quarters, at 52-54 Van Buren street. The circular the company is sending out says: "We invite all our friends to call upon us in our handsome new quarters. Our offices and store are both at this location, we having removed entirely from the Marquette Building. We feel a pardonable pride in our growth. We are in shape to take care of all business in a satisfactory manner, and will appreciate either a personal call or your inquiries by mail." The company has the western agency for the Lea-Hooven arc lamp, "Pittsburgh" transformers and a complete line of general electrical supplies, all of which are displayed to advantage in the new store.

THE EMERSON ELECTRIC MANUFACTURING COMPANY, of St. Louis, Mo., states that it is now making over 200 different kinds of alternating-current motors in sizes of two and one-half horse-power and smaller, and that it is in a position to furnish satisfactory single-phase motors for any alternating current. As many of the central stations do not realize that every motor added on their circuit increases the revenue from their day load, the Emerson Company is anxious to hear from central-station managers and superintendents who are experiencing difficulty in procuring a sufficient load on their day circuits, believing that it can be of considerable assistance to central stations in developing this branch of their business. The Emerson Company will send samples of any size motor it makes to any responsible central station or dealer on 30 days' trial, with the understanding that if the motor is not thoroughly satisfactory, it may be returned at the end of 30 days. This offer will enable any central-station manager to convince a prospective customer that he is in position to furnish satisfactory power service from his alternating-current lines.